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THE PRACTICALITY OF SERIOUS GAMES AS A PEDAGOGY FOR TRAINING ASPIRING INTELLIGENCE ANALYSTS

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ABSTRACT

Using simulations and serious games for the purpose of training and education is no new practice. Serious games have been used by strategists for centuries, with one of the earliest recorded "Kriegsspiel", or "war game", dating back to the early 19th and 20th centuries (Davis, 1995; Graham & Hall, 2012). Today, simulations and games are valuable training tools for a variety of purposes, applications, and contexts. This thesis serves to understand how simulations and games have been practically used as a pedagogy for instructing aspiring intelligence professionals and construct an original analytic exercise based on a sample, four-stage framework designed for its development process. The utility of this original exercise is demonstrated as an activity for Penn State's College of Information Sciences and Technology Undergraduate Recruitment and Student Engagement programs.

Keywords: intelligence analysis, Structured Analytic Techniques, simulations, serious games, analytic exercise

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Chapter 1

Introduction

Rapidly changing and sophisticated phenomena have caused government- and commercial-sector entities to demonstrate an increasing need for dynamic analysts who can find innovative solutions to evolving problems (Coulthart, 2016; Tradecraft, 2009; Valeriu, 2014). These emerging and continuous challenges can affect the critical functions that local, national, and international decision-makers depend upon. From competitive business intelligence collection in the private sector, to intelligence analysis of national security issues, a push for rigorous and timely intelligence assessment has been deemed essential to maintain a competitive edge in an era of globalization (Valeriu, 2014).

The entities working to create usable knowledge from voluminous cluttered and conflicting data depend on future generations of analysts to enter the workforce prepared with a foundational set of analytic skills. It has been difficult to actualize tangible assessments to measure critical thought processes, but in recent decades, the emergence of Structured Analytic Techniques (SATs) has assisted intelligence analysts in positively approaching this effort (Chang, 2018; Coulthart, 2016; Heuer, 2008; Heuer, 2009). Yet, for many aspiring analysts at the undergraduate level or below, gaining a baseline of realistic experience working with these tools still poses a challenge.

Serious games represent unique, interactive engagements for inexperienced analysts to explore foundational knowledge, practice developing focused analytic skills, and tangibly identify areas of strength and weakness. In this sense, a *game* is considered “an activity among two or more independent decision-makers seeking to achieve their objectives in some limiting context”, whereas *serious* suggests that the subject matter of such a game is related to something of importance that will yield significant consequences for participants (Abt, 1987, p. 6). Throughout this research, the term serious game is considered interchangeable with similar, though nuanced, terminology such as *models, simulations,* and *games,* as Abt (1987) also noted. Incorporating a simulation or serious game into modern educational practices serves as an active-learning approach that may prove to be the most effective way to approach complex topics, such as intelligence studies, when used in tandem with traditional classroom or training approaches like lecture (Freeman, et al., 2013; Shelton, 2014).

Nevertheless, the process of serious game construction can be largely time-consuming or impractical for many instructors with either limited operational experience or limited experience in creating or employing realistic, plausible and functional simulations (Fletcher, 1971; Shelton, 2014). There are numerous drawbacks to utilizing simulations, such as knowing which type of simulation or game works best in a given environment or designating a significant amount of time for simulation construction.

To address these and other challenges, literature has been compiled and assessed from various sources; the result has been the identification of several consistent aspects in the development process, regardless of which type of simulation an instructor may decide to develop (Graham, 2014; Hanig & Henshaw, 2007; Law, 2008; Shelton, 2014). Based on principles synthesized within the literature, an original analytic exercise was developed and facilitated in support of Penn State's College of Information Sciences and Technology (IST) Undergraduate Recruitment and Student Engagement programs. There currently exists no official framework to guide simulation construction, particularly in the case of training aspiring analysts (Vlachopoulos

& Makri, 2017). Therefore, to construct this original exercise, a four-stage sample framework was compiled and used to explore the process of simulation design and construction.

Ultimately, the purpose of this thesis is to explore how serious games can contribute to mitigating the challenges associated with timely and accurately analysis of large quantities of intelligence, understand the educational underpinnings that support active-learning strategies to enable higher-level thinking, and create an engaging and effective analytic exercise based on a structured framework to supplement the myriad of resources available to aspiring intelligence professionals.

Chapter 2

Literature Review

A Driving Force: Intelligence Reform and Structured Analytic Techniques

Nearly two decades after the terrorist attacks of September 11, 2001, the effects of policymakers' fervent restructuring and reorganization of the way the intelligence community (IC) collects, assesses, and provides timely analysis to decision-makers are still being felt (Chang, 2018; Lowenthal, 2020; Smith, 2003). Just a few years later, the vital need for United States (US) intelligence professionals to provide quality and timely analysis heightened not long after a second major intelligence miscalculation significantly underestimated the extent of Iraq's nuclear capabilities (Coulthart, 2016). Thus, the Intelligence Reform and Terrorism Prevention Act (IRTPA) of 2004 was enacted to promote the integration of a formal framework and legal oversight support system to help address potential errors in analytic assessments by increasing inter-agency coordination efforts and competitive analysis practices (Chang, 2018; Coulthart, 2016; Heuer, 2008; Lowenthal, 2020; Stephen, et al., 2016; Tradecraft, 2009). The application of Structured Analytic Techniques (SATs) is one approach that has been adopted to alleviate some of the analytic issues and shortfalls the IRTPA sought to address (Chang, 2018; Coulthart, 2016; Heuer, 2008; Stephen, et al., 2016; Tradecraft, 2009).

Despite receiving a magnified public awareness within the last two decades, SATs were formally developed in the 1970s when Richards Heuer explored the possibility of using quantitative methods for analyzing intelligence at the Central Intelligence Agency (Chang, 2018; Coulthart, 2016; Heuer, 2008; Heuer, 2009).

Intelligence is used to forecasts events, assesses uncertainties, communicate to stakeholders, monitor future developments, and assist policymakers in making informed decisions (Chang, 2018; Dhami, et al., 2015; Heuer, 2008; Lowenthal, 2020). Therefore, the IRTPA prioritized the development of a structured IC that could account for as many analytic shortcomings as possible (Chang, 2018; Dhami, et al., 2015; Heuer, 2008).

After the IRTPA was implemented, many, but not all, US intelligence training efforts began to include SATs as fundamental techniques, due to the value of these techniques as “a set of processes for externalizing, organizing, and evaluating analytic thinking” (Chang, 2018, p. 338). Rather than an alternative approach to traditional analytic methods, SATs serve as a series of “best practices” to help promote inter-analyst collaboration, formulate alternate hypotheses, and manage conflicting or vague information (Heuer, 2008; Tradecraft, 2009). Moreover, SATs are intended to help analysts mitigate undetected cognitive limitations, such as biases or heuristics when conducting assessments (Hare & Coghill, 2016; Heuer, 2008; Tradecraft, 2009). Several notable SATs include Analysis of Competing Hypotheses (ACH), Key Assumptions Check, Devil’s Advocacy, and Red Teaming (Tradecraft, 2009).

Benefits of Using Structured Analytic Techniques

SATs were specifically developed as an organized solution to two primary challenges confronting the modern intelligence analyst: cognitive biases and random noise (Chang, 2018; Coulthart, 2016; Heuer, 2008; Heuer, 2009; Stephen, et al., 2016; Tradecraft, 2009). The sheer amount of content an analyst must sift through when searching for relevant information poses a massive challenge, without even considering implicit biases that may influence an interpretation

(Hare & Coghill, 2016; Heuer, 2008; Heuer, 2009). A transparent flow of information, reasoning, and consideration of multiple hypotheses is required for an analyst to reconstruct an objective picture of reality. The collected intelligence may contain significant gaps that prevent the truth from surfacing, and at this point, an analyst's past experiences or prior knowledge may be required to supplement analyses. The analysis process can quickly become complicated if an analyst does not consider degrees of uncertainty, document the logical reasoning process and dispute hypotheses and evidence among peers, or recognize biases influencing the quality of analysis (Dhami, 2015; Heuer, 2008; Heuer, 2009). Collectively, these challenges and the resulting difficulty to produce timely and actionable intelligence contribute to what is often referred to as the "intelligence problem".

The integration of SATs into contemporary intelligence analysis targets the most common and deep-seated biases, as described in **Table 1**, which has been adapted from the US government's Tradecraft Primer (2009). These biases permeate various aspects of thinking and decision-making, such as perceiving realities of a given situation, evaluating evidence quality and relevance, estimating probability despite uncertainty or unknowns, and understanding how actors make decisions (Tradecraft, 2009).

Table 1: Common Perceptual and Cognitive Biases.

Common Perceptual and Cognitive Biases			
Perceptual Biases	**Biases in Evaluating Evidence**	**Biases in Estimating Probabilities**	**Biases in Perceiving Causality**
Expectations: The tendency to recognize what is expected over what is unexpected	***Consistency:*** Coming to conclusions based on a small amount of consistent information, leading to more confidence than conclusions drawn from a greater amount of inconsistent information	***Availability:*** Probability is influenced by how easily an event or similar circumstances can be imagined or have occurred	***Attribution:*** Considering the behavior of actors or entities to be fixed in nature, while considering one's own behavior to be adaptive to changing situations
Resistance: Resisting perception changes despite alternate evidence	***Discredited Evidence:*** Despite the discovery of new evidence that may disprove a perception, the perception itself may not quickly change	***Anchoring***: Probability is narrowly changed even in light of new information or analysis	***Rationality:*** Overestimating the full extent to which other actors or entities pursue a rational, meaningful, and optimizing strategy. Explanations of randomness, accident, or error tend to be diminished.
Ambiguities: Initial ambiguity or uncertainty may inhibit valid perceptions, even with the gradual availability of better information	***Missing Information***: Without knowing all of the information, it can be challenging to assess the potential impact that a few missing pieces of data can have on the phenomenon	***Overconfidence:*** Assessing certainty may lead to overconfident analyses, particularly for highly experienced analysts	

Note. Adapted from "A Tradecraft Primer: Structured Analytic Techniques for Improving Intelligence Analysis", 2009, Copyright 2009 by the U.S. Government.

Heuer (2008) recognized five major ways that SATs contribute to analysts' success despite inhibiting factors: Decomposition and visualization; Indicators, signposts, and scenarios; Challenging mindsets; Hypothesis generation and testing; and Group process techniques.

Table 2 demonstrates the significance of these targeted skills in recognizing and mitigating effects of human cognitive limitations. By targeting these particular areas of weakness, SATs can provide a strong foundation for enabling an intelligence professional to recognize internal cognitive hindrances. The goal of applying SATs is to develop and expand analytic insight through the use of structured exercises for both individual and collaborative assessments.

Table 2: Targeted Skills of Structured Analytics

	Description & Significance of Targeted Skills
Decomposition & Visualization	***Decomposition*** allows analysts to segment large, complex concepts into smaller, easily digestible pieces to allow the analyst to focus on each component separately and in more detail. ***Visualization*** lessens the challenge of individual analysis conducted solely in the "black box" by forcing ideas or evidence into a tangible medium, such as on paper or a screen, which can then be examined, critiqued, or investigated by other analysts.
Indicators, Signposts, & Scenarios	***Indicators*** and ***signposts*** point to some event that will happen. Identification of these elements help analysts recognize when change occurs or is likely to occur. ***Scenario*** development allows analysts to consider the possible conditions in which change could possible occur, which enables the analysts to examine a variety of hypotheses based on alternative circumstances.
Challenging Mindsets	A ***Mindset*** is a "mental model" that guides how humans understand the world and various phenomena. Typically, mindsets are used to formulate assumptions in the face of intelligence gaps or ambiguous information, which can cause major consequences when these assumptions lead to incorrect assessments. By *challenging mindsets*, a thorough analysis can be conducted with recognition of existing cognitive biases.
Hypothesis Generation & Testing	Extensive ***hypothesis generation*** and ***hypothesis testing*** are crucial to avoid satisficing or accepting a "good enough" solution to the problem. Heuer (2009) states that the disregard for several reasonable hypotheses is "among one of the most common causes of intelligence failure" (p. 6). Evidence must be examined and considered against a diverse range of possible hypotheses.
Group Process Techniques	***Group process techniques*** refer to conducting structured analytics more effectively in a group setting; this promotes idea generation and diverse perspectives. The structured processes allow consideration and discussion of conflicting interpretations, which contribute to overall synthesis of the phenomenon.

Note. Adapted from "Taxonomy of Structured Analytic Techniques", by Heuer, R., 2008. Copyright 2008 by Richards J. Heuer, Jr.

The Tradecraft Primer (2009) highlights twelve different SATs separated into three categories to help analysts determine which technique would work best to address a problem (Chang, 2018; Stephen, et al, 2016; Tradecraft, 2009). These categories include: Diagnostic techniques; Contrarian techniques; and Imaginative thinking techniques (Tradecraft, 2009). *Diagnostic techniques* focus on developing and supporting analytic arguments, understanding assumptions, and clarifying intelligence gaps. *Contrarian techniques* serve to specifically and pointedly challenge past or current premises, reasoning, or deeply held beliefs. *Imaginative* *thinking techniques* strive to develop new observations, alternate hypotheses, or different outcome scenarios. Certain SATs are designed to assist with analytic challenges from each category, and some SATs have the structural versatility to target pitfalls across categories, as seen in **Table 3** (Chang, 2018; Heuer, 2008; Tradecraft, 2009). Stephen, et al. (2016) performed a study that found analyses conducted using these techniques effectively considered a wider range of possible scenarios than other analyses that did not apply these processes.

Technique	Category	Description of technique	Targeted cognitive bias or limitation
Key assumptions check	Diagnostic	List and review assumptions on which fundamental judgments rest	Status quo bias; attribution error; wishful thinking
Quality of information check	Diagnostic	Evaluate reliability, completeness and soundness of available information sources	Status quo bias; confirmation bias; selective exposure; inadequate search
Indicators or signposts of change	Diagnostic	Periodically review observable trends to track events, monitor targets, and warn of change	Anchoring and under-adjustment
Analysis of competing hypotheses (ACH)	Diagnostic	Identify alternative explanations and evaluate evidence bearing on hypotheses	Status quo bias; confirmation bias; attribution error; selective exposure; congruence bias; anchoring and under-adjustment
Devil's advocacy	Contrarian	Challenge consensus by building strong cases for alternatives	Confirmation bias, Status quo bias
Team A/Team B	Contrarian	Use of separate analytic teams that contrast two (or more) views	Confirmation bias, Status quo bias
High-impact/Low-probability analysis	Contrarian	Highlight unlikely events with potential policy impact	Status quo bias
"What if?" Analysis	Contrarian	Assume a high-impact event has occurred and explain why	Confirmation bias, Status quo bias
Brainstorming	Imaginative	Use an uninhibited group process to generate new ideas	Status quo bias
Outside-in thinking	Imaginative	Identify the full range of basic forces and trends that could shape an issue	Status quo bias; errors in syllogism, illogical arguments
Red team analysis	Imaginative	Try to replicate how an adversary would think about an issue	Confirmation bias; attribution error; mirror-imaging
Alternative futures analysis	Imaginative	Explore multiple ways a highly uncertain situation can develop	Status quo bias

Figure 1: SATs Targeting Cognitive Biases

Note. Reprinted from "Restructuring Structured Analytic Techniques in Intelligence", by Chang, W., et al., 2018, *Intelligence and National Security*, *33*, p. 339. Copyright 2018 by Routledge Taylor & Francis Group.

A Potential Solution to SAT Implementation Challenges

Despite the intended implementation of SATs as a modern staple of US intelligence training, scholars and intelligence professionals have questioned whether the effectiveness of these practices is measurable across the entire IC. For example, researchers within the last ten years have attempted to scientifically evaluate the use and effectiveness of SATs, finding that although efforts to adopt these techniques have increased, the IC itself does not possess a systematic way to evaluate whether utility of implementation outweighs considerable investment costs (Coulthart, 2016; Dhami, et al., 2015; Dhami, et al., 2019; Hare & Coghill, 2016; Stephen, et al., 2016).

According to an unclassified survey of current IC professionals, one of the greatest disadvantages of using SATs on a daily basis includes a prolonged assessment process that disrupts the high-pace environment of information synthesis (Stephen, et al., 2016). The added process of applying SATs seemingly impedes analysts' abilities to both conduct thorough assessments and meet policymakers' strict deadlines required for intelligence products. This often makes the process of applying SATs or reevaluating pieces of intelligence even more complicated, as rigorous analysis can become increasingly time-consuming as more information is considered.

Further feedback acknowledges that SATs require the user to already be adept analysts, prepared with skills and a reasonable amount of experience for the techniques to actually be effective (Stephen, et al., 2016). Contrastingly, another observed critique of SATs argues the inferiority of using these techniques compared to tried-and-true expert judgement (Stephen, et al., 2016). However, these critiques raise an important question: How can inexperienced analysts gain the necessary skills of an "expert" to ensure quality analysis in such a high-stake environment without expending resources and potentially facing the consequences of a massive analytic failure? In reality, intelligence professionals often spend years focusing on a particular area of study, working to become an expert in that particular topic and acquiring vast analytical capabilities. However, as the next generation of intelligence analysts begin to take the places of certified experts, there is concern of a disconnect between the knowledge and skills of more experienced professionals and incoming novice analysts. **Table 3** demonstrates a compiled overview of critical knowledge, skills, and abilities of successful intelligence professionals.

Table 3: Knowledge, Skills, and Abilities of Successful Analysts

Knowledge, Skills, and Abilities of Successful Analysts		
Knowledge	**Skills**	**Abilities**
• Local, National, or Global Security Issues, Threats, or Risks • How Organizations Operate • How Governments Operate • Influence of Technology	• Critical reasoning • Literacy • Technical Literacy • Research • Foreign Language Proficiency • Information Gathering and Manipulation • Visual Analytics • Use of Geospatial Systems • Project Management	• Creativity • Critical Thinking • Communication Skills (Analytic Writing and Briefing) • Teaming and Collaboration • Problem-Solving

Note. Adapted from SRA 440W Lecture on Principles of Analysis, Graham, J., 2012. Copyright 2012 by Colonel Jacob Graham (Ret. USMC).

Other critiques from this study suggest the techniques have limited use for expert intuition, inadequate versatility to consider quickly changing conditions, and a lacking bandwidth to examine every possible variable in a complex situation (Stephen, et al., 2016). Nevertheless, simulations enable a "trial-and-error" experience, which allows the participants to engage in the simulation to the fullest extent and conduct thoughtful analysis without strict deadlines and workplace pressure. Although there may be some simulated time constraints within the exercise, analysts are generally encouraged to methodically and purposefully consider all aspects of the scenario with an emphasis on practicing and completely grasping the key learning objectives. This type of learning provides intelligence analysts with a reduced likelihood of facing a critical and completely unfamiliar situation in the real-world where there are high costs for analytic mistakes.

Despite practical challenges, the implementation of SATs within the IC is a conscious action toward reducing isolated assessments in a way that promotes objective analysis, thorough scrutiny, and external collaboration among analysts (Heuer, 2008). Furthermore, there are ways to reduce implementation challenges and gauge SAT effectiveness by incorporating these techniques into the context of a serious game for training purposes. Arguably, the most appropriate setting to use SATs is in an education environment, where instructors have the time and resources to teach the next generation of analysts how to think critically, recognize cognitive limitations, and make analytic judgements in a forgiving learning environment. Similarly, in a classroom setting, simulation participants are able to ask questions, receive feedback, and engage with peers to pinpoint areas of strength and weakness. SATs may be incorporated into the structure of a serious game to expose participants to even the most basic form of each technique's use. This practice enables the instructor to tailor lessons to appropriately correspond to participants' skill-levels and further refine training through the application of these concepts during a simulated scenario.

An Overview of Serious Games and Simulations

Serious games provide distinctive, interactive engagements for participants across all skill levels. Analysts with limited experience can explore foundational knowledge, practice developing focused analytic skills, and tangibly identify areas of strength and weakness without fear of making a "wrong" decision. Similarly, advanced participants can explore real-life, high-stake problems, develop realistic mitigation strategies, and assess possible future outcomes. Here, a *game* is considered "an activity among two or more independent decision-makers seeking to achieve their objectives in some limiting context", whereas *serious* suggests that the subject matter of such a game is related to something of importance that will yield significant consequences for participants (Abt, 1987, p. 6). Throughout this research, the term serious game is considered interchangeable with similar, though nuanced, terminology such as *models, simulations,* and *games*, as Abt (1987) also noted.

However, discrepancies still exist regarding subtle implications among various types of simulations, for example, features and elements like the type of environment in which the simulation is run, and the intended purpose, whether team-based problem-solving, honing critical thinking skills, or learning a new analytic technique (Davis, 1995; Graham, 2014; Greenblat & Uretsky, 1977; Jain & McLean, 2006; Kanner, 2007; Lenoir & Lowood, 2003; Libes & O'connell, 2007; Loh, et al., 2016; Waltz, 2014; Yildirim, 2010).

Table 4: Foundational Terminology

Serious Games: Foundational Terminology		
Term:	**Definition:**	**Source:**
Model	A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process.	DoD, 2019
Simulation	A method for implementing a model over time.	DoD, 2019
Serious Game	A game designed for a primary purpose other than pure entertainment.	DoD, 2019

The Department of Defense (DoD) tends to make more use of SATs and has had an entire office devoted to Modeling and Simulation (M&S) since 2006. However, DoD has been applying M&S to training efforts since 1991 (Department of Defense [DoD], 2019a). DoD will periodically release updated terminology used to define specific types of models or simulations, as well as various terms to describe different elements of each (Department of Defense [DoD], 2019b). As seen in **Table 4**, DoD defines a *model* as, “a physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process” (DoD, 2019b). Accordingly, a *simulation* is defined as, “a method for implementing a model over time (DoD, 2019b). Finally, a *serious game* is defined as, “a game designed for a primary purpose other than pure entertainment” (DoD, 2019b).

By examining these terms, it is evident that a simulation utilizing a specific set of tools or designed for a particular training or assessment purpose can be denoted and categorized by including a descriptive word that precedes the foundational terminology. According to Davis (1995), simulations can be further identified by “class”, or rather, the particular way a simulation is presented or run. *Live simulations* incorporate human interaction with systems or other humans; *Virtual simulations* involve humans using a type of simulator, such as virtual operation of a real instrument or method; and *Constructive simulations* involve simulated actors who are tasked with providing inputs to operate simulated systems (Davis, 1995; DoD, 2019). These are examples of the types of simulations used by DoD within their Warfare Modeling and Simulation (M&S) initiative to assist with military planning, preparation, training, and evaluation (Davis, 1995). However, there is not one *best* type of simulation or game; in fact, depending on what aspect of reality an instructor chooses to represent, there may be more than one type of simulation selected to achieve a given training objective (Davis, 1995).

In the field of intelligence analysis, simulations are often referred to as *analytic games*, which specifies that these methods are utilized in support of the intelligence process (Waltz, 2014). Waltz (2014) further identifies three categories of *games* and the foundational principles for which each type is used. In an *Exploration and Learning* game, participants can examine behaviors, relationships, and potential outcomes. *Assessment* games require participants to evaluate multiple decisions and factors under changing circumstances. *Training* games allow participants to experience a particular situation to improve understanding of possibilities, limitations, and consequences of their actions. Using serious games to illustrate a segment of reality and achieve training objectives has grown in popularity, capability, and potential over the past century; however, this is by no means a novel concept.

Transformation of Serious Games

Serious games have been used by strategists for centuries, with some of the earliest recorded dating back to the early 19^{th} and 20^{th} centuries (Davis, 1995; Graham & Hall, 2012). Prussian general of staff, Georg Leopold von Reisswitz, introduced and formally adopted “Kriegsspiel”, or “war gaming”, into Prussia’s military officer training in the beginning of the 19^{th} century (Davis, 1995, Graham & Hall, 2012; Schollmeyer, 2006). The US military followed suit about half a century later after the end of the Civil War, when the practice of war gaming was formally included in military academy curriculum (Graham & Hall, 2012).

However, the use of war gaming in US military planning became more widely popularized during World War II, when mathematical approaches dominated the nation’s strategy to address operational challenges (Davis, 1995). Military operations research was becoming prominent after the war ended and eventually transitioned into an academic field in the 1950s (Davis, 1995). Analysts began applying models to strategic and political issues, particularly developing simulations related to the nuclear conflict of the Cold War and the roles of each faction of the military within the greater schema at strategic, operational, and tactical levels (Davis, 1995; Graham & Hall, 2012). As time went on, game theory was incorporated into simulations to compensate for weaknesses that had previously ignored or were criticized for excluding political or other "soft" factors (Davis, 1995).

The 1970s marked a transition from a dominant mathematical approach to an interactive gaming approach that increased the weight that "soft" factors, such as morale and surprise, have on a situation (Davis, 1995). In the 1990s, following the end of the Cold War, warfare modeling shifted its focus from nuclear interaction to analyzing complex regional conflicts with a variety of scenarios (Davis, 1995). New and emerging challenges, such as information warfare, required a refocused approach to simulations in which a greater emphasis was placed on flexibility, timely development, and resource-allocation in the face of shrinking budgets (Davis, 1995). Visualization graphics continued to increase in quality, both visually and in terms of interactivity; however, the importance of human war gaming also increased in value by providing opportunities for critical insights and analysis (Davis, 1995).

Today, serious games demonstrate value, not only in the role of military war gaming, but also in a wide range of purposes and disciplines, such as the medical field (Gordon, et al., 2001; Keating, O'donnell & Starr, 2012), crisis management (Jain & McLean, 2004; Quanjel, et al., 1998), international relations (Kanner, 2007; Raymond, 2010), marketing (Gundala & Singh, 2016), operations management (Klassen & Willoughby, 2003), and intelligence analysis (Dhami, et al, 2019; Graham & Hall, 2012; Waltz, 2014).

Additionally, simulations exist across a variety of fields for the purpose of classroom education. A few examples include: Business processes (Klassen & Willoughby, 2003); Crisis response (Bowers & Webster, 2015); Marketing (Gundala & Singh, 2016); Medical student career exploration (Keating, O'donnell & Starr, 2012); Mitigating analytic biases (Raytheon, 2012);

Intelligence analysis (Graham, 2014; Shelton, 2014); and US response to international issues (Recent Past Simulations, n.d.).

Benefits of Incorporating Serious Games

There are numerous benefits to using serious games and simulations as tools for training and education, such as creating opportunities for performance measurement, prompt feedback, and collaborative problem-solving. Because of these and other positive aspects, simulations have been proven advantageous to both organizations developing skilled employees and individuals pursuing greater understanding of a concept or process.

Using a simulation as a training method is a common approach within organizations (Smith, 2003). A simulation can exercise a specific skill, such as how to physically use a particular tool, practice a defined strategy, or engage in a virtual simulator (Smith, 2003). The simulation environment provides an immersive experience in which participants can role-play as if they are actually receiving information, making decisions, and solving real-world problems without the danger of inciting real-world consequences (Smith, 2003). Thus, a simulation or game developer has a unique vantage point of identifying the challenges that plague these roles and assessing which skills are necessary to solve the problem. The developer can design a series of scenarios in which the participants must learn and use a specific skill or strategy to find a range of possible solutions. Lahneman and Acros (2014) noted that even short exercises and games can be effective active-learning methods to promote participants' understanding of new or complex material, particularly involving intelligence tradecraft.

In a simulation environment, there still may be negative effects stemming from a participant's poor decision, misuse of a theory, or communication error; however, these consequences become teachable moments, rather than real-world blunders. In the forgiving learning environment of a simulation or game, an individual or group may make mistakes when facing practical challenges without fearing larger repercussions that may affect the organization in real life (Smith, 2003).

Furthermore, the simulation facilitator may decide to pause the gameplay to focus on particular elements of the scenario or analytic process to ensure participants fully understand a key concept or critical protocol action. Observers can evaluate the performance of participants within the simulation and provide feedback in a timely manner, if not immediately (Quanjel, et al., 1998, Smith, 2003). Such an evaluation may be used to determine or address current knowledge gaps within the organization or examine the effectiveness of a newly implemented emergency response protocol or business practice (Campbell, et al., 2008; Jain & McLean, 2006). In 2004, the National Institute for Science and Technology (NIST) published a framework detailing best practices for integrating modeling and simulation into business methods, known as the integrated Emergency Response Framework (iERF) (Jain & McLean, 2004).

A simulation may require participants to delve into uncertain circumstances and make decisions or evaluations based on different factors within the situation. This means that receiving feedback on how well or how poorly the participants are meeting simulation objectives is critical to ensuring a productive learning session, otherwise, no new knowledge is gained by either party (Quanjel, et al., 1998, Waltz, 2014). Teamwork and collaborative problem-solving are other common areas in which simulations provide a great amount of insight and training assistance (Quanjel, et al., 1998, Smith, 2003). In these ways, simulations provide an opportunity for organizations to explore situations of high risk and responsibility by allowing participants to explore how their actions affect and are affected by complex scenarios with multiple actors and phenomena. Integrating simulations into workplace training can preserve precious resources in real-life, such as emergency response time or expended funds for remediation work. These opportunities can enable participants to identify areas of improvement, practice necessary skills, and understand how and why simulation tasks should be replicated in real-life (Smith, 2003).

Simply stated, an intelligence agency is also an organization striving to meet its own objectives and produce deliverables. Accordingly, there are significant benefits when simulations are used in the field of intelligence analysis. For example, the limitations of using SATs in real life can be reduced when these methods are incorporated into a simulated scenario.

Simulations provide a means to explore a segment of reality and immerse participants in roles that enable them to overcome the limitations of isolated analysis by delving into several possible hypotheses, considering multiple scenarios from a variety of perspectives, cooperating with associates to solve problems, and examining the potential for intelligence operations (Smith, 2003; Waltz, 2014). In this way, analytic games provide the unconstrained environment necessary to develop comprehensive understanding of relevant theory and practice of SATs, while applying these concepts to a scenario that mirrors some aspect of reality (Quanjel, et al., 1998). This takes the form of conducting assessments under varying levels of uncertainty, examining the effects of several courses of action, recognizing biases in decision-making, making decisions that have consequences within the realm of the game, and calculating the impact of these effects as if they happened or could happen in the real-world (Quanjel, et al., 1998; Waltz, 2014).

As previously mentioned, two of the most common challenges for a modern intelligence analyst are cognitive biases and random noise, both of which must be reduced to produce quality analysis. SATs may be applied to minimize the effects of these challenges; however, as seen within the IC, there is no systematic evaluation for the effectiveness of such methods in the workplace.

Still, SATs may be incorporated into a serious game structure to teach participants how to use new techniques and determine which techniques are optimal to use in particular contexts. These techniques can be practiced in conjunction with another learning objective in the simulation, or as a standalone objective. The simulation developer determines the type of learning objectives for a given simulation and, therefore, is responsible for providing timely and constructive feedback to the participants (Quanjel, et al., 1998). This is perhaps the most important and beneficial aspect of gaming: participants essentially have the chance to practice their reactions to existing or potential real-world stimuli in a low-stakes environment. These participants are encouraged to engage, explore, and learn more about available tools to overcome challenges and implications associated with decision-making. Analytic games also promote cooperativity among participants, particularly in the development of shared mental models and challenged worldviews, which many SATs also seek to achieve (Quanjel, et al., 1998). By placing participants in a situation requiring collaboration with peers, participants are enabled to learn from one another and view the simulation from a different perspective. The team and competitive aspects of a simulation can also lessen the pressure placed on a single novice analyst attempting to solve a complex problem alone.

Serious Games in Education: Educational Objectives and Bloom's Taxonomy

In recent years, researchers have assessed the benefits and limitations of simulations as a pedagogy for undergraduate and professional education. Many educators and intelligence professionals believe simulations have a plethora of benefits when compared to "traditional" learning styles, such as lecture (Abt, 1987; Arthurs & Kreager, 2017; Lahneman & Acros, 2014; Pillar, 2013; Shelton, 2014; Vlachopoulos & Makri, 2017). To understand the roles of simulations and games as pedagogies for training intelligence analysts, inherent strategies will be examined, and other common teaching methodologies will be contrasted.

To understand the significance of simulation- and game-based learning when applied to intelligence analysis, it is important to first explore the foundational educational objectives necessary to improve human cognition. Depending on a simulation's participants' level of cognition, learning methods must be adjusted appropriately and can ultimately impact whether the experience will yield a successful learning outcome.

In 1949, Benjamin S. Bloom and a group of education specialists in the US developed a system of categorization to improve communication among educators, establish consistent evaluation standards, and institute realistic learning objectives (Armstrong, n.d.; Bloom et al., 1956; Krathwohl, 2010; Seaman, 2011). This framework became known as "Bloom's Taxonomy" and has been incorporated into a wide range of teaching and learning disciplines over the course of more than 60 years (Adams, 2015; Armstrong, n.d.; Bobrowski, n.d.; Forehand, 2011; Seaman, 2011). This classification system assists instructors in determining foundational curriculum and appropriate examination design throughout primary, secondary, and higher education courses (Adams, 2015; Armstrong, n.d.; Bobrowski, n.d.; Seaman, 2011).

According to Bloom's taxonomy, there are three critical skill domains that contribute to the learning process: the cognitive domain, the affective domain, and the psychomotor domain (Bloom, et al., 1956; Bobrowski, n.d.; Forehand, 2011). The *cognitive domain* houses six levels of knowledge-based objectives regarding factual and conceptual knowledge (Adams, 2015; Bloom et al., 1956; Bobrowski, n.d.; Forehand, 2011). Similarly, the *affective domain* contains five levels of attitudinal-based objectives, while the *psychomotor domain* contains six levels of skills-based objectives (Armstrong, n.d.; Bloom et al., 1956; Forehand, 2011). Each of these domains contains respective objectives that gradually increase along a scale of complexity from lower-order to higher-order achievements.

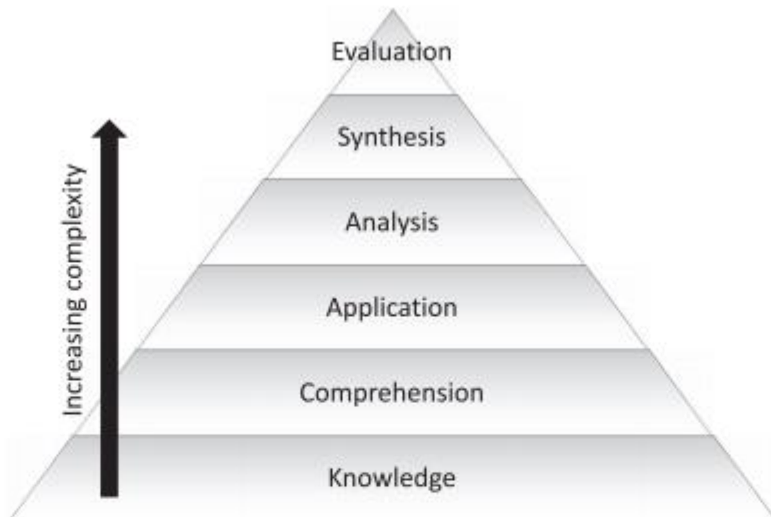


Figure 2: Original Bloom's Taxonomy: Hierarchy of Cognitive Learning Objectives

Note. Reprinted from "Bloom's taxonomy of cognitive learning objectives", by Adams, N., 2015. *Journal of the Medical Library Association, 103,* 152. Copyright 2015 by Nancy Adams.

Much focus has been directed toward cultivating and evaluating the six cognitive domain levels, which, as **Figure 1** demonstrates, consist of the following objectives in ascending order from least to most complex: *Knowledge, comprehension, application, analysis, synthesis,* and *evaluation* (Adams, 2015; Armstrong, n.d.; Bloom, et al., 1956; Forehand, 2011). Scholars later identified the first three objectives – Knowledge, Comprehension, and Application – as "*lower-order*" skills and the latter objectives – Analysis, Synthesis, and Evaluation – as "*higher-order*" skills (Adams, 2015). The taxonomy was designed as a multi-tiered, hierarchical model in which the simpler skills that form the base of the structure must be mastered before progressing to the more complex skills and objectives located at the top of the structure (Bloom, et al., 1956;

Forehand, 2011; Tutkun et al., 2012). **Table 6** provides brief descriptions of each of these six skills, or learning objectives, in the cognitive domain.

Table 5: Original Bloom's Taxonomy of Cognitive Domain Learning Objectives

Cognitive Domain Learning Objectives		
Learning Objective	**Description**	**Citation**
Knowledge	"The recall of specifics and universals, the recall of methods and processes, or the recall of a pattern, structure, or setting."	Bloom, et al., 1956, p. 201
Comprehension	"A type of understanding or apprehension such that the individual knows what is being communicated and can make use of the material or idea being communicated without necessarily relating it to other material or seeing its fullest implications."	Bloom, et al., 1956, p. 204
Application	"The use of abstractions in particular and concrete situations."	Bloom, et al., 1956, p. 205
Analysis	"The breakdown of a communication into its constituent elements or parts such that the relative hierarchy of ideas is made clear and/or the relations between ideas expressed are made explicit."	Bloom, et al., 1956, p. 205
Synthesis	"The putting together of elements and parts so as to form a whole."	Bloom, et al., 1956, p. 206
Evaluation	"Judgments about the value of material and methods for given purposes."	Bloom, et al., 1956, p. 207

In 2001, a revised version of Bloom's taxonomy was published by Lorin Anderson and a group of scholars containing previous contributors to the original taxonomy and some of Bloom's former students (Anderson et al., 2001; Armstrong, n.d.; Forehand, 2011). The revised taxonomy resembles the original but contains six newly defined categories using active verbs instead of static concepts: *Remember, Understand, Apply, Analyze, Evaluate, and Create*.

The revised publication stresses a more dynamic application of the taxonomy by removing the notion of strict, hierarchical "educational objectives" (Armstrong, n.d.). Rather, Anderson, et al. (2001) accentuate the importance of each category's affiliated sub-categories, using "action words" to focus on the learning process taking place, as seen in **Table 6**. Each category and respective sub-categories emphasize particular learning processes that educators may desire their students to achieve. In terms of understanding educational objectives for aspiring intelligence analysts, this version of Bloom's taxonomy better addresses the evolving analytic landscape and places value in creativity and intuition in problem-solving. The most significant change is the taxonomy's transformation from a rigid hierarchical structure a flexible process that can be exercised in both convergent and divergent methods based on a foundation of knowledge (Anderson, et al., 2001; Tutkun et al., 2012).

Table 6: Revised Taxonomy of Cognitive Processes and Related Processes

Cognitive Domain Learning Objectives		
Category	**Sub-Category**	**Citation**
Remember	Recognizing, Recalling	Anderson, et al., 2001, p. 31
Understand	Interpreting, Exemplifying, Classifying, Summarizing, Inferring, Comparing, Explaining	Anderson, et al., 2001, p. 31
Apply	Executing, Implementing	Anderson, et al., 2001, p. 31
Analyze	Differentiating, Organizing, Attributing	Anderson, et al., 2001, p. 31
Evaluate	Checking, Critiquing	Anderson, et al., 2001, p. 31
Create	Generating, Planning, Producing	Anderson, et al., 2001, p. 31

Note. Adapted from "A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives", Anderson, L., et al., 2001. Copyright 2001 by Addison Wesley Longman, Inc.

Understanding Bloom's taxonomy is critical for educators and particularly relevant in the field of intelligence. In the Digital Age of continuous technological and communications advancement, a new generation of intelligence professionals who receive, process, understand, and generate information in vastly different ways than their predecessors will soon be ushered into significant decision-making roles (Pillar, 2013). Before they can assume the massive responsibilities of the intelligence process, each analyst must be prepared with the tools to succeed. Simulation learning and serious gaming offer a solution for aspiring intelligence professionals, contrary to solely relying on traditional training approaches such as lecture or case study (Abt, 1987; Arthurs & Kreager, 2017; Lahneman & Acros, 2014; Pillar, 2013; Shelton, 2014; Vlachopoulos & Makri, 2017). In fact, the use of games in the practice of education has continued since the late 1950's, consisting of both "all-man" and "all-computer" exercises in order to make classroom evaluation more objective (Cherryholmes, 1966). Simulations have increased in popularity and practice over the last several decades for undergraduate education, and the need for intelligence training to follow suit is growing as well.

In 2017, researchers Vlachopoulos and Makri conducted a literature review on the use of games and simulations as a pedagogy in higher education and concluded that these methodologies have the potential to enable students to achieve learning objectives. The researchers also found that when serious games were incorporated within a traditional learning environment, three learning outcomes were ultimately impacted: the *cognitive, the behavioral*, and *the affective* (Vlachopoulous & Makri, 2017). These elements directly relate to Bloom's understanding of the three domains of skills of critical importance to the learning process, as previously established: the cognitive domain, the psychomotor domain, and the affective domain.

Establishing properly constructed learning objectives is critical when educating aspiring analysts to ensure an effective transfer of knowledge (Adams, 2015). An approach guided by Bloom's taxonomy may enable educators to conceptualize lower- and higher-order skills and abilities required of intelligence professionals (Adams, 2015).

However, as established by Vlachopoulos & Makri (2017), "there is currently no formal policy framework or guidelines recommended by governments or educational institutions on the adoption of games and simulations in education", particularly in higher education (p. 2). Educational approaches that do not incorporate simulations and gaming are not taking advantage of a wealth of opportunities to make the achievement of some of Bloom's taxonomy's more abstract objectives tangible through hands-on learning opportunities. Nevertheless, efforts to educate and train undergraduate students in intelligence practices have utilized simulation and gaming to develop participants' higher-order skills since the 1980s (Lahneman & Acros, 2014).

A major challenge for these programs has not been obstinacy against incorporating serious gaming into curriculum, but rather the lack of formally structured criteria to help specify how a simulation might yield a comprehensive immersion into the intelligence process and produce the desired analytic skills (Lahneman & Acros, 2014). However, Hanig and Henshaw (2007) assessed another challenge that goes beyond the limitations of serious games: "There really are few standard methods of analysis. Analysts are left largely to their own devices in developing systems for processing intelligence and depend on coordination with other analysts to catch the errors" (paragraph 4). Still, there have been attempts to counteract this fact and promote the development of productive and tangible training solutions for future analysts, with SATs being one such example (Pillar, 2013). Indeed, the skills of critical thinking and analysis inherently rank as higher-order skills on Bloom's taxonomy; therefore, both seasoned intelligence professionals and aspiring analysts must reinforce and further develop these skills over time (Shelton, 2014; Zoller, 1993). Lahneman and Acros (2014) argue that the education of intelligence professionals should include conceptual elements, such as how to think critically and conduct effective analyses, as well as more abstract concepts rarely acknowledged in the classroom environment, such as ethics, industry terminology, organizational structures, business processes, and examples of analytical pitfalls.

There is considerable value in learning about both the tangible and intangible aspects of intelligence analysis, but there are fewer opportunities to provide a complete picture when the information is distributed stagnantly solely through traditional means, such as lecture (Lahneman & Acros, 2014). With the help of Bloom's taxonomy, learning objectives may be established and prepared for use in an educational environment by experienced intelligence professionals. Once critical skills are defined, serious games may be incorporated to elicit the inherent development and practice of applying these relevant concepts.

Enabling Critical Skills Development through Serious Games

Simulation- and game-based learning provide opportunities to enhance the educational experience by creating a tangible environment in which the systematic development of key skills and abilities may be practiced and refined by novice and professional analysts alike (Campbell, 2011; Lahneman & Acros, 2014; Pillar, 2013). Simulation engagement requires participants to physically perform desired skills and become cognitively engaged with higher-level thought processes that enable further understanding and application of the concepts (Sitzmann, 2011). In fact, some participants cannot completely understand the underlying implications, challenges, and uses of certain tradecraft techniques without first actively engaging with the methods themselves (Lahneman & Acros, 2014; Shelton, 2014).

In order to prepare future intelligence professionals for the increasingly high expectations of timeliness, correctness, and relevance set by policymakers, serious games and the integration of Bloom's taxonomy can be used to emphasize a more dynamic educational experience that increases and strengthens both analytic minds and capabilities (Hanig & Henshaw, 2007; Shelton, 2014). Placing novice analysts in an environment where they are challenged by realistically stressful situations forces them to assess their own ways of thinking, identify the existence of implicit biases or distorted mindsets, and verbalize any underlying assumptions that may be contrary to reality (Hanig & Henshaw, 2007). This kind of immersion provides unique opportunities for intelligence analysis training as a social science by reinforcing key course concepts, communicating a variety of conditions or information among team members, and establishing underlying motivations within competitive and challenging scenarios (Abt, 1987; Kanner, 2007; Shelton, 2014; Vlachopoulos & Makri, 2017).

Within the simulated environment, focus is shifted from the instructor to the participants, with an emphasis on observable skills and application thereof, as well as problem-based learning opportunities in which participants must assess a scenario and identify how to apply the knowledge gained throughout an associated course (Hanig & Henshaw, 2007; Kanner, 2007; Vlachopoulos & Makri, 2017). Most importantly, any mistakes or missteps made within the simulated environment have no effect on real-world phenomena; therefore, exercise participants can receive usable feedback from instructors without the fear of disastrous consequences or embarrassment (Abt, 1987; Hanig & Henshaw, 2007; Kanner, 2007; Vlachopoulos & Makri, 2017). By experiencing a real-world-based scenario, participants can appreciate the challenge of the complex art of intelligence and recognize the significance of existing shortcomings that even seasoned analysts must overcome, such as biases, mental mindsets, and intelligence gaps (Hanig & Henshaw, 2007; Shelton, 2014).

Serious games also take a problem-based learning approach in which scenarios are presented to participants who must then apply relevant skills or knowledge to make decisions and achieve the game’s objectives. This type of active learning, or role-playing, enables participants to examine complex situations in which a single decision may initiate a string of unforeseen possibilities, particularly on subjects like international relations (Kanner, 2007, Raymond, 2010).

In everyday life, simulations are used to provide training to management personnel, accountants, bankers, businessmen, advertisers, salesmen, Foreign Service officers, Peace Corpsmen, schoolteachers, soldiers, and the IC based on specific problems that may arise as these individuals are working “on-the-job” (Abt, 1987). For example, the military frequently utilizes planning games to solve strategic problems such as transportation or evaluating uncertainty such as upcoming weather forecasts (Abt, 1987). Conducting intelligence analysis requires the same kind of training approach. Solving complex puzzles with incomplete information is the primary objective for intelligence professionals, which means these individuals must interpret information they possess, recognize the absence of critical information and understand the significance of the unknown information (Lahneman & Acros, 2014; Shelton, 2014). By providing simulated contexts in which individuals may practice responses to normal and unexpected phenomena, participants may attain a further appreciation for the field and the associated challenges that intelligence professionals must navigate in the real-world (Shelton, 2014).

Teamwork, collaboration, and communication are also key pillars of the intelligence process. As students engage in team-based gaming environments, they may experience an increased level of accountability for making substantial contributions toward the achievement of the objective (Kanner, 2007; Shelton, 2014). However, the degree of engagement largely depends on a student’s motivation to learn.

There are multiple factors that contribute to a participant’s motivation and willingness to take part in a team-based activity, such as a simulation. A supportive classroom environment, for example, paired with a variety of thought-provoking, realistic, and relevant tasks may increase participation (Lumsden, 1997). Thus, by using simulations and games as a means to facilitate classroom study, participants may be more inclined to take part in a lesson that emphasizes the exercise's contextual value and showcases a somewhat more competitive theme (Garris, Ahlers, & Driskell, 2002; Lumsden, 1994). Nevertheless, simulations are not a singular solution to inducing participation, but they do provide participants with a vehicle to naturally explore conceptual theories in a realistic environment and collaborate in discussions about scenario hypotheses with peers (Hanig & Henshaw, 2007).

Comparing Teaching Methods and Optimizing Serious Games in Education

Numerous teaching methodologies, pedagogies, and best practices exist across the field of education, and certainly each has its own benefits and limitations in helping students improve cognitive skills. Throughout this research, it has been argued that serious games greatly contribute to the learning process, particularly in the education of aspiring intelligence professionals. It is necessary to further explore what precisely differentiates serious games and simulations from other "traditional" methodologies, namely lecture and case study, as well as how these methods prove to be most effective when used as part of a combined approach.

The core element that separates *traditional lecture* from serious games is the emphasis on what type of learning is engaged: passive or active, respectively (Arthurs & Kreager, 2017; Garris, Ahlers & Driskell, 2002; Sitzmann, 2011). A passive learning strategy facilitated through lecture evokes a passively receptive learning standard for students to adhere to, which, while oftentimes is a useful way to express new information suitable for lower-order cognitive processing, may be insufficient as a standalone means to train students to advance their understanding and attain higher-order cognitive skills (Garris, Ahlers & Driskell, 2002; Lahneman & Acros, 2014; Sitzmann, 2011). Contrastingly, an active learning strategy strives to engage students in dynamic activities during class time to directly promote student-oriented discovery and development of higher-order skills (Arthurs & Kreager, 2017; Freeman, et al., 2013).

Depending on the learning objectives, an instructor may choose to employ passive or active methods to achieve varying educational goals. Lecture has been used for centuries, quite possibly since the founding of historical Western European universities (Arthurs & Kreager, 2017). This method is best utilized to transmit basic facts and information to a receptive group of learners, and for learning certain characteristics of intelligence topics, lecture is typically the most efficient method to use (Arthurs & Kreager, 2017; Lahneman & Acros, 2014).

However, despite a traditional approach to education remaining prominent in modern society, the educational landscape has vastly evolved over the last century, from emerging pedagogies and cognitive theories, to information accessibility through mediums such as the internet (Arthurs & Kreager, 2017). As evidenced by Bloom's taxonomy, there are still more elements to learning besides information recall, and the simple transfer of information from instructor to student may not be enough exposure for a student to grasp more complex or arbitrary topics (Arthurs & Kreager, 2017).

Additionally, instructors may struggle with the challenge of relaying the complexity of higher-order thinking topics in a limited amount of in-class time, which further inhibits opportunities for active learning in the classroom (Arthurs & Kreager, 2017). Researchers have argued that more abstract concepts, such as motivations, constraints, interactions, situational awareness, and other intelligence-related theories, can be explored extensively and yield a greater understanding when practiced in an active-learning environment (Kanner, 2007; Lahneman &

Acros, 2014; Lee Chang, et al., 2017). Furthermore, employers strive to hire students who can complete tasks and produce high-quality results based on relevant theories, particularly in high-stakes fields such as intelligence (Garvin, 2000; Gundala & Singh, 2016). Too often, students may lack the necessary experience or skills necessary to solve problems or find success in a competitive environment to apply their knowledge to actionable decisions (Gundala & Singh, 2016). Thus, it is critical to provide hands-on experiences for students to apply abstract concepts in practice, grasp the significance of lecture topics, and appreciate how classroom learning relates to real-world phenomena (Garvin, 2000).

An alternative teaching methodology widely used in education throughout nearly every academic field, including medicine, law, engineering, business, planning, architecture, and public policy, is the *case study method* (Francis, 2001; Yin, 2018). At its core, a case study is a story used to describe an actual or fictional real-world event relevant to the subject-matter for the purpose of demonstrating a theory or academic concept in practice (Francis, 2001; Yin, 2018). Selecting a case study for use in an educational setting is much different from the case study *research* method, as case studies used as an educational tool do not require the rigor of manipulating and presenting empirical data (Yin, 2018).

The case study method was originally used at Harvard to express legal principles where participants would analyze a legal dilemma and assess the case as if it was occurring for the first time during the class (Case Study, n.d.). Thus, students gained analytic practice and collaboration skills by working through the narrative, roleplaying, and making decisions that could have, theoretically, affected the outcome of the event (Case Study, n.d.). Similarly, the Harvard Business School case study approach exemplifies a series of business-related scenarios, using the same concept as the case study method (Case Study, n.d.). The business school case study differs, such that the cases are not related to the field of law, but rather, the business world (Case Study, n.d.). In this sense, the purpose of case study method is adapted to teach participants of various fields teamwork, decision-making, and theoretical application in a real-world-based situation. The case study teaching method was also expanded to nearly every field of study, from medicine to public policy, and even to intelligence (Francis, 2001; Lahneman & Acros, 2014; Yin, 2018). Through this means, students of higher education, executives, and professionals may further understand the challenges in various situations and learn how to actively and adeptly approach complex problems (Case Study, n.d.). For example, at the conclusion of the case study, students may be tasked with presenting to a fictional stakeholder or client, performing a related exercise, debating with other students, assessing leading principles and theories, or engaging with a guest speaker currently working in the field (Case Study, n.d.).

Regarding intelligence analysis, this approach certainly could fill the active-learning deficiency in current undergraduate education strategies (Lahneman & Acros, 2014). However, there is a crucial difference between case studies and serious games that must also be considered. Case studies largely rely on a structured, oftentimes linear, framework in which participants must make decisions without seeing immediate consequences as a result. Although the concepts surrounding case studies and serious games are similar – promote active learning, provide an environment in which to practice critical skills, attain a further understanding of an event by experiencing it as someone in the field would – there are slight differences that may persuade an instructor to choose one methodology over the other. For example, serious games can be difficult to build from scratch, which may be necessary if an exercise does not already exist that effectively targets the desired skills or subject matter. Case studies, on the other hand, can be as simple or complex as needed; these narratives are either taken verbatim from a real-world event and analyzed by participants, or they are slightly altered to better reflect a particular instance or develop a focused skillset. However, serious games allow the students to develop hands-on experience, which can be rare for students of intelligence and is incredibly appealing to potential employers (Garvin, 2000). Analyzing case studies involving decision strategies is certainly useful, but participants can exercise a completely different set of skills by actually going through the analytic process themselves (Gundala & Singh, 2016). Nevertheless, both of these methodologies employ active-learning strategies, which has only been increasing in importance for aspiring students of intelligence analysis.

There are numerous opportunities to employ traditional lecture, case study, and serious games to yield beneficial results in an educational setting. A combination approach is particularly advantageous, in which passive and active learning strategies are used in tandem to inspire students to pursue careers in their respective fields.

Intelligence analysis is a culmination of theoretical and abstract concepts that make the essence of the field inherently challenging to grasp and even more complicated to translate to others (Lanheman & Acros, 2014). Intelligence professionals must memorize, access, and apply terminology in a timely manner and be able to realize higher-level relationships, causes, and effects; thus, these individuals must be adept in both lower- and higher-order cognitive processing skills (Shelton, 2014). Researchers have found connections among the type of educational strategy employed, a student's motivational process, and whether the learning outcomes were ultimately effective (Arthurs & Kreager, 2017; Garris, Ahlers & Driskell, 2002). This means that a combined approach utilizing strategies that cultivate both types cognitive skills can provide a well-rounded educational experience and positively affect the way students learn intelligence concepts.

With technological advancement and information accessibility, some students may not be as inclined to engage in lecture during class-time if the information is readily available through another medium; therefore, if the majority of passive-learning through simple information or terminology transfer is emphasized outside of class, students may be more willing to engage in active-learning activities during class (Arthurs & Kreager, 2017; Claiborne, et al., n.d.; Shelton, 2014). When exercise participants recognize course material within the serious game or simulation environment, they may be able to attain greater insights, understand relationships, or identify theoretical and real-life connections (Shelton, 2014). Serious games as a standalone pedagogy are impractical; however, when used to supplement course material, they provide an immersive experience into the subject-matter that enables participants to broaden their critical processing abilities (Shelton, 2014; Sitzmann, 2011).

Furthermore, by engaging students with an active-learning strategy, the instructor shifts the focus of the classroom from "teacher-centered" to "student-centered", which enables students to explore the skills needed for real-world success with a sense of independence and discovery (Freeman, et al., 2013; Gundala & Singh, 2016). The serious game itself provides a break from the strain and monotony of lecture, which is designed to promote curiosity and excitement about the field, and in turn, increase students' overall interest in the subject-matter (Claiborne, et al., n.d.; Shelton, 2014). Not only are traditional educational methods still functional in this combined approach, but exercise participants also learn a variety of skills, including how to interact with peers in the social context of serious games (Freeman, et al., 2013; Shelton, 2014). In this way, students can attain practical skills that employers desire, gain a further understanding of course material, and develop an appreciation for the challenging subject-matter, while simultaneously building a proper skillset to overcome real-world obstacles.

Drawbacks of Using Serious Games

Despite the benefits of incorporating serious games as a pedagogy for instructing aspiring intelligence analysts, there are several limitations and drawbacks to this approach. The most significant drawback is the practicality of serious games in a classroom environment, which can be broken down further into four main elements: construction, feasibility, participant motivation, and likelihood of successful learning outcomes.

Firstly, the process of designing and developing a fully functional simulation or game can seem largely time-consuming or impractical for instructors or simulation developers with limited experience in this practice (Fletcher, 1971; Shelton, 2014). The development process can become overwhelming without proper supports, and when additional challenges like limited resources or complex topics are involved, some instructors may determine that incorporating a simulation is not worth the time and effort required (Shelton, 2014). In addition to deciding to embark on the construction process itself, the way a developer constructs a simulation is equally critical. If a developer approaches the project without preparing the necessary resources, identifying explicit learning objectives, and selecting an appropriate medium by which to present the scenarios, then the simulation may not be as useful as it was intended. From one perspective, a simulation is a creative work and therefore requires the same amount of commitment as a writer might give to a novel. However, a simulation is more than just a creative work; it serves a greater purpose of educating and training its participants in specific skills. Therefore, the construction process should allow for both creative and analytical approaches, with both elements effectively communicated to the audience. A developer must recognize that significant time will be set aside to allow for multiple revisions and critical evaluations of the simulation’s usefulness and relevance (Fletcher, 1971). Limited preparation time and collection of resources also play a role in dictating the instructor’s ability to build modernized simulations to reflect evolving phenomena. Inexperience, discomfort with “non-traditional” teaching methods, disconnect between the realities of the field and the scenarios presented in the simulation, among other factors, remain common obstacles to effective construction and implementation of simulations (Shelton, 2014). Garris, Ahlers & Driskell (2002) found there is also a great risk of “designing instructional games that neither instruct, nor engage the learner” (p. 442). This risk is often enough to deter seasoned instructors from taking on the lengthy, challenging process of simulation development.

Secondly, in some cases, the feasibility of a simulation may inhibit an instructor from implementing this training method in a given learning environment. There is only so much time allotted to training and educating, and a simulation depicting a certain segment of reality may not have the capacity to enable the students to fully realize the important elements of the scenario (Loh, Li & Sheng, 2016). Corporate training sessions are typically even more time- and resource-constrained than a semester-long, undergraduate course, for example. An aspiring developer may have a compelling theme and learning objectives, but if resources are limited, the developer may be discouraged from ever pursuing the engagement. Furthermore, the facilitator must coordinate with the developer, if they are not the same person, to verify that the simulation can realistically run in the designated environment. Additional factors, such as participants’ initial levels of preparation or post-simulation learning outcomes must be considered and are often the cause of structural modifications along the development timeline. Determining whether a simulation approach is feasible relies on the instructor and developer to understand the exercise’s realistic added value, how to identify an appropriate type of simulation for their needs, and how to best refine the details of a simulation to supplement the learning process (Shelton, 2014).

Next, the motivation of a simulation’s participants upon beginning the exercise can determine the participants’ receptiveness to the material itself. Scholars have noted that some participants may decline full participation or immersion into serious games because of an exercise’s childish representations, reliance on extrinsic rewards, or rather difficult or unexplained tasks (Fletcher, 1971; Lo, Li & Sheng, 2016; Lumsden, 1994; Stephen, et al., 2016). A developer must be able to create an engaging simulation that sparks participants’ curiosity without being too challenging, and yet, actively simultaneously transfer knowledge through a type of narrative structure. This is no simple task to overcome, even for seasoned developers and facilitators. Nonetheless, active-learning methods rely on the transfer of knowledge through engaging activities, although Fletcher (1971) notes that simply requiring participants to perform tasks in a simulation or game does not necessarily confirm that the learning process is taking place. Some participants will not have a strong motivation to learn or participate, while others will be content with poor performance or failure to draw connections from the various tasks (Fletcher, 1971). These concerns must be reflected upon when deciding if a simulation is the best approach for educating a particular group. Tailoring a simulation to the skill-level of the participants is a key element that may help address issues of lacking motivation. If the simulation’s fundamental theme and learning objectives significantly deviate from the knowledge and experiences of the participants, then there is a lesser likelihood that the participants will effectively grasp the concepts practiced in the exercise. Not all individuals are intrinsically motivated to learn and understand unfamiliar concepts, therefore, supplemental training opportunities may need to be offered to participants to address this issue before taking part in the exercise. It is important to note that developers must also possess considerable motivation themselves in undertaking simulation development and facilitation. A majority of the groundwork for employing this pedagogy must be laid by the developer in terms of planning, construction, and facilitation (Graham, 2014). If an instructor does not have a compelling desire to work through a project such as an original serious game in its entirety, then it may be in the individual's best interest to select an alternate educational strategy.

Finally, the likelihood that the simulation will yield successful learning outcomes must be weighed against the costs of construction and implementation. The ultimate goal of building and using simulations as a pedagogy for training and education is to have a complete, practical experience that can help a group of learners achieve critical skills. Successful transfer of knowledge is the bottom-line of education; therefore, this task must be the driving force of all simulation or game development. In a limited timeframe, a developer must consider whether the participants may feasibly attain the skills or knowledge expected within the simulation environment, or if another pedagogical approach may be a better option. Boocock & Schild (1968) mention one of the key factors in using simulations and games in education requires a translation of educational objectives and real-life methods into the simulation itself. In this way, the duty of the potential developer is to constantly evaluate the course or training content with a critical eye to determine how best to reconfigure the essence of the material and appeal a new audience. The balance of emphasizing active-learning methods and refraining from relying on streamlined "box-checking exercises" is also crucial, as rudimentary tasks with minimal intellectual strain that rely on external motivators may lead to unfavorable learning outcomes (Stephen, et al., 2016). Supplemental materials such as readings, discussions, outside resources, and real-life connections to the simulation can provide a well-rounded learning environment that effectively preserves the focus of the course on relevant information (Shelton, 2014). Simply experiencing and completing a simulation does not ensure that the participant attained understanding of foundational learning objectives and contextual applications (Fletcher, 1971). Therefore, this is one of the most complex drawbacks to using simulations as a pedagogy for training participants. A simulation developer must recognize the significance of communicating necessary information to complete the simulation clearly and concisely, such as through learning objectives and evaluation criteria, so that participants are aware of the developer's expectations.

Ultimately, regardless of the methodology selected, education is not an objective experience that can be fast-tracked with a single pedagogical approach. Rather, education, and particularly intelligence training, is a completely subjective experience that must be tailored to reflect the strengths and weaknesses of each student or trainee. Simulations and games are but one opportunity to use in the field of intelligence analysis to address well-known analytic shortfalls and uniquely approach the education of future generations of intelligence professionals.

Chapter 3 An Original Analytic Exercise and Sample Development Framework

Based on key principles of construction synthesized from the preceding literature, an original analytic exercise was developed and facilitated in support of Penn State's College of IST Undergraduate Recruitment and Student Engagement programs. This exercise serves to supplement the wealth of opportunities and event programming available for aspiring students of intelligence analysis through the College of IST to learn more about tangible skills and practice applying analytic techniques in a realistic scenario. Additionally, the exercise was developed to gain first-hand experience in using structured analytics as guidelines when conducting analyses and recognize various circumstances in which these techniques may be applied. The completed simulation, entitled, "The Smithmine Explosion", is an hour-long exercise directed toward high school students with limited experience in analytic thinking and writing. This exercise is designed to introduce participants to the concepts of applying structured analytics to solve a multifaceted problem and practice the analytic writing, or "Bottom-Line-Up-Front" ("BLUF") writing style.

Appendix A contains a complete collection of the reference materials for the resource packet, while **Appendix B** contains all background documents and pieces of intelligence for participants. The analytic worksheets needed for this exercise are located in **Appendix C**. Should this exercise be run in a classroom environment, each participant will receive one of each document compiled into a packet in order as listed, excluding those documents that fall under facilitator materials. This simulation can work for a large group of participants broken into teams of two to four people. Alternatively, due to the increase in demand of virtual offerings as a contingency for traditionally "brick-and-mortar" events, a virtual version of this exercise has been made available through the College of IST and may be accessed upon request.

For this exercise, a four-stage sample framework was compiled and used to demonstrate the process of simulation design and construction. Simulations have been used for centuries; therefore, suffice to say there is not one “correct” formula to create a successful exercise. Nevertheless, several consistent aspects of simulation development as a process were identified based on the literature (Graham, 2014; Hanig & Henshaw, 2007; Law, 2008; Shelton, 2014). These characteristics were then combined into an adaptable framework that helped to guide the construction of this particular analytic exercise, as shown in **Figure 3**.

This example development process is hierarchical in the sense that each stage must be completed progressively before the developer can transition to the subsequent stage, as indicated by the darker arrows in the figure. However, if a developer reaches a later stage and identifies an inconsistency with preceding tasks, the developer can return to an earlier stage and evaluate the necessary preceding tasks, as indicated by the curved arrows flowing toward the top of the figure. See **Table D1** in **Appendix D** for a completed version of the sample simulation development framework with a summary of each stage in this construction process.

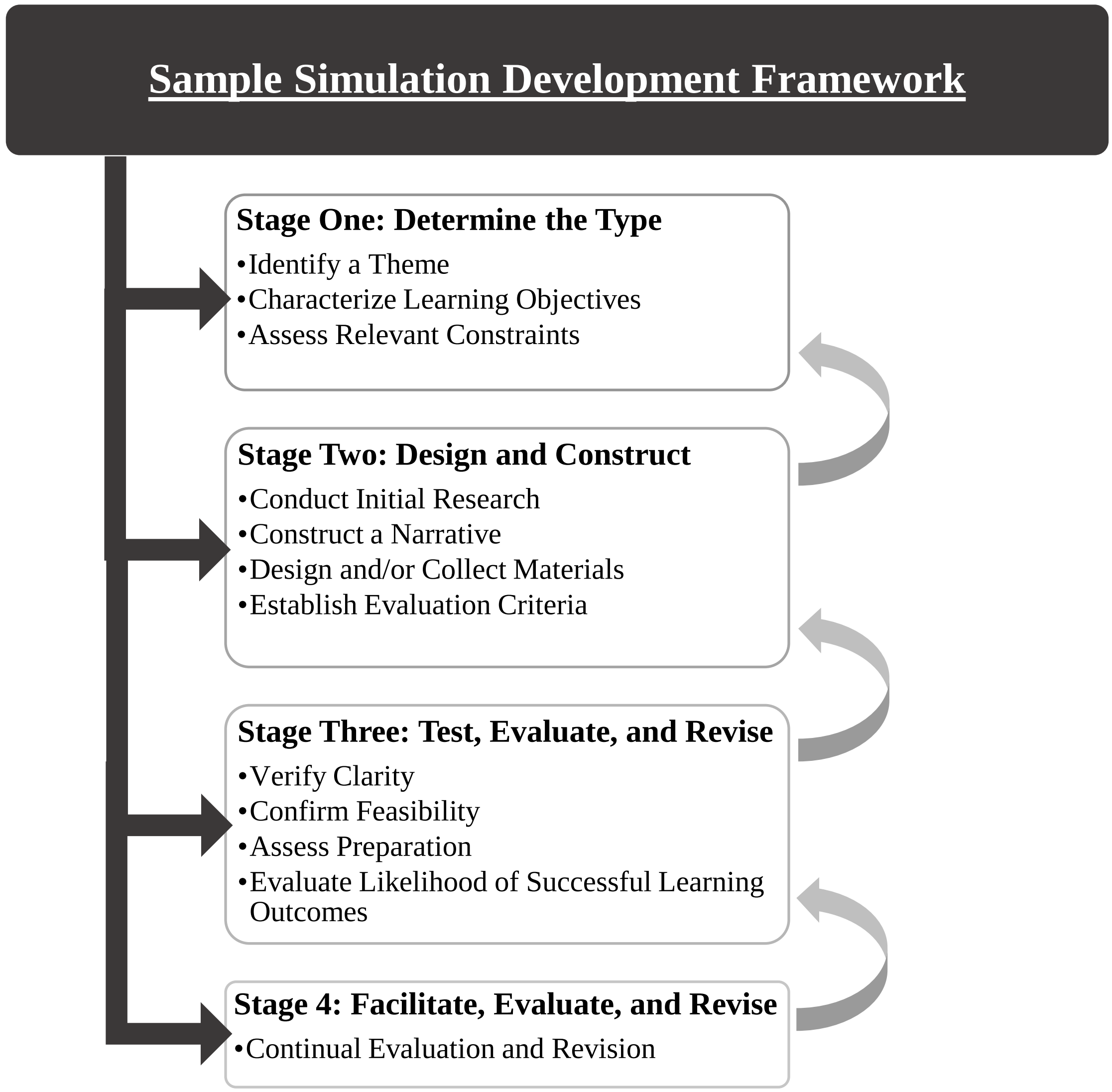


Figure 3: Sample Simulation Development Framework

Stage One: Determine the Type of Game or Simulation Required

There are three components in the first stage of the framework used to create this exercise: *Identify a Theme; Characterize Learning Objectives*; and *Assess Relevant Constraints.* These sub-tasks are not hierarchical; rather, they possess an interconnected relationship and may be completed at the discretion of the designer. Some decisions regarding one task may have an effect on the decisions that will be made concerning another task, and in this case, working concurrently on multiple tasks was a necessity. These three tasks are foundational components that helped the developer to successfully determine the type of game or simulation required for the appropriate context. The type of simulation selected for “The Smithmine Explosion” was an *analytic exercise*, based on the identified theme, learning objectives, and relevant constraints.

Identify a Theme

The starting point of this simulation’s development was the wider context in which the activity would be used. This was a significant factor in determining what type of simulation worked best and what the overarching theme of the simulation itself would be. Identifying a theme essentially meant first understanding that simulations are not standalone products; augmenting traditional learning methods by incorporating a simulation required a unified approach to simulation development. This included ensuring that the topics addressed in the simulation corresponded appropriately to the topic of the course, lesson, or training program, which the simulation served to supplement (Graham, 2014). Relevance to the participants, realistic tasks the participants would be expected to complete in the real-world, and the intended learning objectives were also critical to the daunting challenge of inspiring the participants with the proper motivation to actively participate (Raytheon, 2012).

A key to designing “The Smithmine Explosion” simulation was identifying a theme that enabled prolonged relevance and longevity of the exercise. It was important to recognize that participants would expect some kind of relationship between the activity and the broader context in which the simulation was run. An obscure topic that had little relevance to the participants or the associated learning objectives would have decreased the exercise’s usefulness. Furthermore, the topic had to be intriguing enough that a group of inexperienced participants would be motivated to engage and complete the prescribed tasks. Because the intended participants for this exercise were expected to have limited familiarity with intelligence matters, the topic also had to be sensitive and simple enough to explain in a single session, yet also urgent and complex enough to spark interest for participants who may want to pursue formal study of intelligence analysis in the future.

The theme of domestic eco-terrorism was selected because these types of violent acts remained a significant concern in the US throughout the mid-2000s, with property damage accruing hundreds of millions of dollars, and yet current phenomena are somewhat lesser-known in contemporary media when compared to other major national security threats (Jarboe, 2002). Additionally, as opposed to threatening human life, ecoterrorism targets and tactics are typically directed at the destruction of property with monetary or symbolic value, which seemed like a sufficiently restrained context in which to expose novice participants to analytic techniques. Therefore, the serious topic of terrorism could be discussed without provoking or marginalizing any particular ideologies and by focusing on an act of violence committed against objects, as opposed to people.

Characterize Learning Objectives

It was important for the developer to completely define the learning objectives before simulation construction began, as the number and type of learning objectives affected the scale of the simulation and whether additional entities or resources were required throughout the design process. Simulations and games can be used to achieve numerous intelligence-related learning objectives, such improving creative thinking, conducing assumptions or motivation checks, assessing analytic capabilities, investigating collection strategies, recognizing heuristic pitfalls, completing deliverables within strict deadlines, and fostering the use of SATs (DeLeon, 1981; Frank, 2012; Graham & Hall, 2012; Lahneman & Acros, 2014; Waltz, 2014).

The way a simulation frames achieving learning objectives can also contribute to how participants may be motivated to engage (Raytheon, 2012). For example, participants may be tasked with simply achieving a goal, regardless of the type of method or structure used, and the participant's performance will be determined based on whether the goal was accomplished. Alternately, participants may be instructed to focus on engaging in a learning process or technique without being evaluated on the outcome. Similar to many analytic exercises, "The Smithmine Explosion" exercise focused on the latter, because it was understood that the targeted group of participants did not have a firm grasp of analytic terminology or how to use critical thinking techniques to solve a complex problem. Therefore, the key learning objective for this exercise was not for participants to reach a particular conclusion, but rather, to gain experience in using two fundamental SATs – Key Assumptions Check and Devil's Advocacy – and to draft a report using the analytic writing, or "Bottom-Line-Up-Front" ("BLUF") writing style. Because this was essentially an introductory opportunity, the focus of this analytic exercise highlighted the core skills of successful analysts and actively engaged participants in a hands-on challenge to spark interest in the field and practice of intelligence analysis.

Assess Relative Constraints

Project planning was a central priority for this simulation, particularly when assessing and anticipating relevant constraints throughout the development process. It was important to understand the constraints and plan effective countermeasures before actually designing and constructing the simulation. The developer in this case had to serve as her own project manager and take the time to consider all restraining factors before beginning development. **Table 7** shows three main constraints: *Resources*, such as Capital, Materials, Size and Scale, Collaborators, and Schedule and Deadlines; *Theme and Learning Objectives*, such as Preparing Participants and Verifying Consistency; and *Anticipated Likelihood of Success*, which includes Evaluating Risks.

Table 7: Relevant Constraints for Simulation Development

Relevant Constraints for Simulation Development		
Resources	**Theme and Learning Objectives**	**Anticipated Likelihood of Success**
• Capital • Materials • Size and Scale • Collaborators • Schedule and Deadlines	• Preparing Participants • Verifying Consistency	• Evaluating Risks

Available Resources

Capital can be one of the most significant factors in determining the limitations surrounding how the developer will to design and construct a simulation. Sources of income must be identified, such as grants or scholarships, and the time period from application to income receipt must be considered in the development timeline. Thus, it was critical to evaluate the necessary expenses that may have incurred across all stages of development, such as development facilities, materials required, wages for collaborators, and any software or hardware needed for facilitation. Fortunately, this exercise did not require expenses in these areas because there was only one developer who was able to utilize available resources in collaboration with the College of IST. Additionally, all of the content used in the exercise was completely original, with the use of open-source resources to supplement background information on the subject-matter. For some simulations, researching scholarly articles or academic journals or licensed copyrighted content may be needed for more thorough narrative designs, which may require additional expenses. Each developer’s budgetary constraints will vary based on additional external circumstances.

A simulation’s size differentiates between a single exercise meant to be completed in a short amount of time and a string of activities meant to be achieved over a longer period of time. The scale of a simulation refers to the amount of materials required, financial resources to be expended, and the intensity and involvement of collaborators on the development team supporting the simulation’s success. Task structure was considered at this stage of development: Will the developer decide to utilize team- or individual-based problems (Shelton, 2014)? How many participants is the developer planning to engage? Will the problems be scripted or reactive (Graham, 2014)? How long will each participant have to complete a task? Will the simulation tasks be based on existing training frameworks (Jain & McLean, 2004)? Are the participants expected to learn new material as they work through the simulation, or will everything discussed in the simulation environment be prior knowledge? Is replayability a key characteristic of the simulation, or will the participants only benefit from a single trial (Raytheon, 2012)? The size and scale of this exercise were limited by the timeframe allotted to many of the College of IST programs: one hour-long session in a single classroom. A minimum of three facilitators were required to run the simulation, one to address the whole group and keep time, and two to circulate the room and assist in helping individual teams. These numbers are accounting for a group of approximately 30 participants, broken into about 10 teams of two to four participants. The exercise can be adapted for any number of participants, as long as each team has at least two people. This analytic exercise is fitting for the context of recruitment and engagement programs because it is concise enough to be shared in the allotted, one hour-long setting, and yet, it has the potential to be expanded with greater discussion if facilitated within a longer period of time.

Although “The Smithmine Explosion” was designed and built by a single developer, several collaborators contributed significant feedback throughout various points in this design process. Collaborators can take many forms, including co-developer roles, including subject-matter experts, supervisors, or advisors. It is important to consider the additional constraints of involving collaborators, namely coordinating schedules, unifying visions for the project, and maintaining deadlines. For this exercise, there was one primary developer who frequently consulted with advisors and professors with vast simulation development experience, as well as with supervisors and staff members of the College of IST Undergraduate Recruiting and Student Engagement, who all provided feedback on the exercise’s appropriateness for the intended participants.

The materials required to construct the simulation largely depends on the type of simulation to be developed. For example, a virtual simulation would require considerably different materials than a live simulation. Materials can include the tools needed to construct the simulation like hardware and software, facilitation specifications like cloud storage or application development, or learning resources for participants like note sheets, interactive elements, or licenses for certain tools. There were several materials needed for construction of “The Smithmine Explosion”. Microsoft Word was utilized to create all supporting documents and worksheets, Box Cloud

Storage was used to store all the related documents, and a personal or IST computer was needed to conduct initial research and access the documents themselves. Regarding facilitation, most of the materials required took the form of a document: Reference documents containing all key terminology used in the simulation, background documents and message traffic that make up all the intelligence to be analyzed, analytic worksheets to practice using the SATs, a post-simulation self-evaluation questionnaire, and facilitation materials such as a PowerPoint and speaker notes. These materials were printed and compiled into an exercise packet which was given to participants to help streamline facilitation. It was useful to create a comprehensive list or outline of all materials required for the development process and consider materials needed for eventual facilitation before simulation construction began.

The most precious resource available to simulation developers is time. Every other resource will undoubtedly affect the final schedule and anticipated deadlines, which makes this constraint one of the most important to consider before any kind of construction begins. Understanding how long a certain type of simulation will take to be constructed is crucial to maintaining consistency with deadlines and ensuring a satisfied consumer at the end of the project. For example, a multi-entity, multi-week simulation may take several months to fully develop, whereas, the development of an hour-long analytic exercise may take only a few weeks, depending on additional constraints. In this case, the development schedule was largely guided by mandated deadlines associated with this thesis, as well as upcoming College of IST event dates. This analytic exercise was facilitated at a College of IST program on March 21, 2020. The first test-run of the exercise was planned for approximately one month before the date of the event, with a volunteer training planned for the week before the event. Leading up to these deadlines, time had to be considered for research, narrative development, analytic worksheet and supporting documents development, as well as revisions and feedback from collaborators. For this one-hour-long exercise, development took approximately one month, with two additional weeks for feedback, revision, and testing.

Theme and Learning Objectives

At this stage, it was critical to verify consistency among the theme of the simulation, the prescribed learning objectives, and participants' preparedness. The themes involved were determined simplistic enough to correspond to the experience-level of the participants, but mature and compelling enough to intrigue the participants. These components combined with an emphasis on problem-solving were determined relevant enough to a group of participants that may not necessarily be motivated to participate in an intelligence-driven exercise.

The participants' skill levels and knowledge of the material were anticipated to be very minimal. Shelton (2014) states that "students with prior exposure to the key concepts examined in the simulation will derive greater insight as a result and will more easily connect their experiential learning to previous substantive preparation" (p. 269). Additionally, Graham (2014) notes that supplementary tasks must incorporate knowledge previously available to ensure the participants are prepared with fundamental skills to successfully complete the simulation. Therefore, the participants needed to have supplemental reference material provided to them before engaging in the simulation. Once these materials were prepared and time during the exercise was allotted for proper explanation and instruction, the overall anticipated likelihood of the simulation's success needed to be evaluated.

Anticipated Likelihood of Success

At this point in construction, the greatest risks associated with this simulation included allotting sufficient time to complete each task and motivating participants to engage in the exercise. The selected theme, subject-matter, realistic role-playing, step-by-step outlines for applying each technique, and varied intelligence mediums to analyze seemed to provide enough versatility and engagement to spark participants' interest. All participants were to be divided into teams of two to four people and were expected to collaborate within their teams to complete the supporting worksheets using SATs and analytic writing. Most significantly, no outside resources would be needed during the exercise, as all necessary materials would be provided by the facilitator. In these ways, the relative constraints were assessed, and the developer was prepared to continue to the second phase of this exercise's development framework.

Stage Two: Design and Construct

Stage Two of the design process for this exercise contained four main components: *Conduct Initial Research*; *Construct a Narrative*; *Prepare Supporting Materials*; and *Establish Evaluation Criteria.* Each of these interconnected elements relied on the foundational theme, learning objectives, and associated restraints, as determined in the previous stage. The flexible framework structure allowed for the developer of this simulation to return to Stage One and make any necessary modifications to the three core components if needed. Actual design and construction of the exercise were conducted throughout this stage of the sample framework.

Conduct Initial Research

Once it was determined that an analytic exercise would be the most appropriate choice, initial research into other similar exercises was conducted. To achieve an accurate representation of reality, it was critical for the developer to actively engage with relevant subject-matter through research, exploration, and discussion, particularly because the developer does not regularly design intelligence-driven simulations (Davis, 1995; Graham, 2014; Law, 2008). Although a developer may recreate a simulation based on an actual event, the developer of this exercise decided to create a scenario with wholly fictional actors and events. Nevertheless, research was conducted to maintain credibility and consistency among the simulated environment and realistic entities, events, and processes.

Specifically, simulation and exercise structures were examined in discussions with advisors and by reading academic journals about classroom simulations. Additionally, a further review of existing SATs was conducted to determine what type of technique could be showcased and easily explained to this particular group of participants. Selecting the appropriate skills to serve in support of the underlying learning objectives was integral to ensuring the simulation's relevance to the participants. The Key Assumptions Check and Devil's Advocacy structured analytics were selected because they are relatively simple, foundational techniques upon which to build the type of skillset necessary to perform more complex analyses. For both SATs and "BLUF" writing style, additional resources were compiled into a resource packed for the participants to use during the exercise. This information would then be taken home with each participant after the event and could provide guidance for further exploration of the techniques. Regarding the selected theme of ecoterrorism, research was necessary to include realistic elements of this phenomenon, such as active and historical organizations, communication strategies, frequently used tactics, and common targets. Finally, research on intelligence documents and message formats was also conducted to mirror realistic messages from various sources, such as a social media profile.

Develop a Narrative

Formulating a narrative structure for this exercise required the most creativity. The underlying narrative of a simulation is what strings each task together in accordance with the research to create a realistic environment. In this simulation, participants would be instructed to complete tasks that employ key learning objectives; however, without a compelling context, the participants' motivation may be limited to simply completing tasks with no understanding of the material's real-world application.

As Shelton (2014) states, "at the most basic level, a simulation should be enjoyable to students and, by being enjoyable, increase student retention and interest in lecture and discussion materials" (p. 266). The narrative should be the defining context that will ultimately shape the participants' decisions that impact the outcome of the simulation (Shapira-Lischinsky, 2013; Waltz, 2014). Depending on the knowledge and skillset of the incoming participants, the narrative appeal may also play a factor in encouraging participant engagement. Using a popular or well-known theme, such as a detective role-play, can promote a sense of familiarity at the offset, which the developer can use to appeal to a wider audience and reduce the need to explain everything involved in the narrative (Raytheon, 2012).

The developer designed this simulation so that participants would examine pieces of intelligence and assemble a portrait of reality based on both relevant and irrelevant information found within the narrative. It was most efficient to draft the completed narrative and define concrete facts of the scenario, also known as *ground truth*, before any kind of contradictory information was included, as recommended by both Graham (2014) and Shelton (2014).

The following is a summary of the fictional narrative behind “The Smithmine Explosion” analytic exercise: An explosion occurred at the Cityville Convention Center during the Smithmine Convention, the largest annual natural resource extraction convention in the US. Participants will take on the role of an FBI Joint Terrorism Task Force (JTTF) to determine if and how terrorism could have been involved with this disastrous event. After examining intelligence reports, identifying evidence to support hypotheses, checking key assumptions, and performing devil’s advocacy, the JTTF must provide a BLUF-style analytic brief to high-level decision-makers detailing each team’s findings of the investigation.

Prepare Supporting Materials

Supporting materials refer to any logistical or administrative resources that are required to complete the simulation or game. These materials can take the form of narrative elements, simulation tasks, or participant preparation resources. At this point in development, the exercise narrative’s ground truth and additional information had been drafted, but the medium by which this information would be shared with participants needed designed and constructed. All simulations utilize some kind of supporting materials to function; for example, traditional war gaming often exercised components like multicolored game pieces, maps, and a series of rules, among other supplies (Lenoir & Lowood, 2003). Many modern simulations involving intelligence analysis or international relations utilize a variety of information sources from which participants must pull relevant evidence or conduct assessments. These can include agency intelligence reports, weapon systems profiles, various maps, satellite images, ‘encrypted’ emails, wire-tapped telephone transcripts, media articles, among others (Graham, 2014; Shelton, 2014).

Figure 4 shows the complete materials list, as taken from the sample simulation development framework in **Appendix D**. These items echo the materials previously listed under the resource section; however, at this stage they have become more specified and tangibly created. The burden of creation falls primarily on the developer to provide a realistic experience by properly researching elements of formatting and structure, creating all of the necessary supporting materials, often from scratch, to effectively produce a convincing segment of reality (Graham, 2014; Shelton, 2014).

Prepare Supporting Materials:

- Background and Supporting Documents
    - Participant Role/Background
    - Intel 1: Local News Report on the Explosion
    - Intel 2: On-Duty Security Staff Profiles
    - Intel 3: Cityville Convention Center Maintenance Reports
    - Intel 4: Suspicious Facebook Profile
- Facilitator and Volunteer Materials:
    - Exercise Timeline
    - Volunteer Roles and Responsibilities
    - Facilitator Presentation and Speaking Notes
    - Full Narrative – Key
    - Evidence Tracker – Key
    - Analytic Worksheets – Key
- Analytic Worksheets
    - Evidence Tracker
    - Key Assumptions/Devil’s Advocacy
    - Final BLUF Step-by-Step Guide
- Key Terminology Resource Documents
    - Intelligence Analysis
    - Structured Analytic Techniques
    - Key Assumptions Check
    - Devil’s Advocacy
    - BLUF/Analytic Writing

Figure 4: List of Prepared Supporting Materials

Additionally, all logistic elements must be provided for the participants to ensure smooth facilitation (Graham, 2014). For this simulation, this included securing a location for facilitation and acquiring supplies required to perform interactive tasks, printing resource documents and analytic worksheets, and gathering additional materials to support team-based problem-solving.

Similarly, the developer must consider how the participants are expected to achieve the simulation's learning objectives. It was essential for the developer to engage the participants in a practical application of the desired skills, as simulations are not effective vehicles for passive-learning (Graham & Hall, 2012). Rather, hands-on elements are the defining characteristic of simulations as a pedagogy. In many simulations, these activities may come in the form of analytic exercises, worksheets, reflections, presentations, group discussion, or a final briefing session (Shelton, 2014). In "The Smithmine Explosion", participants were presented with a table to fill with evidence taken from the intelligence reports, a worksheet to guide their key assumptions checks and devil's advocacy practice, and a deconstructed "BLUF" worksheet with step-by-step guidance. The participants were instructed to work within their teams and prepare a final "BLUF" based on the provided worksheet, which was shared with the rest of the group at the conclusion of the exercise.

The developer also had to ensure all materials were in place for the facilitator, because in this case, the developer was not intended to facilitate this exercise at future events. The facilitator's materials included correct solutions to the exercises, discussion points to expedite group analysis, a presentation with speaker notes for briefing participants on simulation terminology, and general instructions for volunteers helping individual participant groups. Ensuring that all relevant materials are in place for the facilitator and participants helped the simulation run more efficiently.

Finally, it was critical for the developer to understand that every tool, concept, or practice emphasized or implied in the simulation must be recognizable by the participants to produce the best possible learning outcomes (Graham, 2014; Shelton, 2014). The developer determined that because the participants would be absolute novices to intelligence analysis practices, all key terminology and learning objectives would be discussed in a brief before beginning the exercise. Despite the daunting work involved in development, a useful characteristic of simulations, including this one, is that once all the materials have been assembled, the entire simulation can be reused with various groups of participants (Shelton, 2014).

Establish Evaluation Criteria

Defining evaluation criteria is essential to verifying the success of the simulation because the developer can only understand if learning objectives were successfully imparted by whether the participants meet these criteria. Therefore, the developer of this exercise had to consider the appropriate tools with which to measure a positive learning outcome.

There are many ways to evaluate the success of a simulation, depending on the type of simulation and learning objectives. The most important aspect to consider when establishing evaluation criteria is having realistic expectations of what exactly participants are intended to gain from working through the experience. Transparency and clear communication of the developer's expectations is crucial to ensuring the results of the simulation ultimately have meaning.

One of the benefits of simulations in learning environments is enabling the participant to explore concepts, practice skills, and receive constructive feedback on how to improve. The kind of feedback and evaluation criteria will largely depend on the current skillset of the participants and the expected skills the participants should attain by the end of the simulation, whether from performing some task or actually completing the simulation (Graham, 2014; Shelton, 2014; Pillar, 2011). Some important questions the developer considered include: How would the participants tangibly demonstrate their knowledge? Would there be an examination or a presentation at the end of the simulation? What would be the consequences if participants do not attain the key learning objectives? Reflecting on the reasons behind evaluating the participants helped the developer decide the best way to frame the learning objectives and promote a practical simulation.

This exercise serves as an introduction to the techniques and realities of intelligence analysis. Therefore, it was an exploratory experience that did not require explicit criteria to be met, other than simply practicing specific analytic techniques and becoming familiar with common terminology. However, at the conclusion of the exercise, the participants were provided with a one-page self-evaluation as part of the take-home resource packet. Participants then would have the option to complete a five-question worksheet to define key terminology from the exercise on their own time and use the resource packet to assist with any difficult definitions. This inclusion enables participants to test their knowledge of these concepts outside the simulation environment and possibly help promote participants' future interest in the field of intelligence analysis.

Stage Three: Test, Evaluate, and Revise

Stage Three of the design process used to develop this exercise contains four components that must be evaluated completely, although in no particular order: *Clarity*, *Feasibility*, *Preparation*, and *Likelihood of Successful Learning Outcomes.* This stage was intended to gain a thorough understanding of the significant pitfalls, inconsistencies, and plot holes in the drafted simulation at this point. Once again, the interconnected framework structure allowed the developer to return to preceding stages and make any necessary modifications to the drafted simulation. A test-run of the exercise was conducted during this stage to assess each of the four components.

Clarity

A crucial characteristic of this simulation's success was ensuring absolute clarity among the developer's learning objectives, the relationship between the context of the scenarios, and the developer's expectations of the participants throughout the simulation. Although the developer began the development process with a particular vision, this task forced the developer to re-examine the information presented, identify any communication gaps, and address additional oversights that may have inhibited participants from understanding exactly what the developer wanted them to take away from the experience. Clear expectations of performance and promising outcomes also helped the developer reinforce the achievement of key learning objectives. During the test-run, the test-participants noted the background information was concise and easy to follow. One test-participant mentioned the deconstructed "BLUF" writing style template was particularly useful for novice participants with no experience in analytic writing. It was critical to break down the three-step "BLUF" format and provide specific questions for participants to answer that directly requested the type of information the supposed “exercise decision-maker” would expect to receive.

Another element to consider was simplicity in narrative design and task structure. An extremely complex simulation could risk becoming overwhelming and distracting from the core training objectives for which the exercise was intended. Shelton (2014) acknowledges the challenge of effectively balancing a compelling narrative against ensuring clear relationships among relevant components and including random noise to make the intelligence problem as realistic as possible. This was a concern in “The Smithmine Explosion” because four pieces of intelligence were involved that contained both important and irrelevant information. The test-run indicated there was a reasonable balance of both to keep participants motivated to engage and sufficiently challenged throughout the exercise.

Ultimately, the test-run indicated the exercise tasks enabled participants to identify tangible relationships among the learning objectives, relevant real-world contexts, and immediate task expectations.

Feasibility

Assessing the feasibility of the simulation at this stage focused on the developer’s prospect of successful facilitation, rather than construction. The available resources were reconsidered: Capitol, Size and Scale, Collaborators, Materials, and Schedule and Deadlines.

The developer determined the current and anticipated budgetary restraints that may continue upon facilitation were a nonissue at this point in development. The feasibility of the drafted simulation’s size and scale were evaluated by detailing and assigning supporting roles and materials preparation to enable proper facilitation. The developer double-checked that all materials needed for the finalized simulation could be feasibly attained within the allotted schedule and in accordance with the prescribed deadlines. The reevaluation of available resources did not indicate that the initial design and construction of the simulation needed to be significantly altered to ensure facilitation success.

The feasibility of conducting the drafted simulation in the prescribed setting was also assessed. The test-run occurred in a smaller classroom than the actual facilitation would take place; however, the test-participants were still broken into groups to reflect the team-oriented simulation dynamic and were able to effectively participate.

Lastly, the feasibility of transferring facilitation knowledge and materials was examined by discussing the exercise timeline and background information with members of the College of IST staff who would be in charge of facilitating the exercise during future events. It was determined that this exercise could serve as a feasible addition to the wealth of engagement opportunities the College of IST provides during recruitment and engagement programs.

Preparation

Evaluating the simulation for adequate preparation required the developer to consider the simulation materials, participants, and future facilitator(s). At this point, the developer assessed the simulation for any missing or poorly assembled materials related to facilitation specifications and learning resources for participants. These include slide decks, speaker notes, timelines, analytic worksheets and multiple methods of accessibility.

Preparing the participants with appropriate knowledge to understand tasks and new information in the simulation was crucial to the simulation's value as an educational tool. The test-participants ranged from having very little knowledge of applying analytic terminology and theory to those who are full-fledged intelligence aspirants. This range of skill-levels meant that the developer was able to receive a holistic panel of feedback to help improve the exercise.

Overall, the test-participants determined the deconstructed worksheets were effective in promoting the practice of the structured analytics and analytic writing throughout the exercise. There were a few cosmetic corrections and additions to the final exercise, but the core content and materials provided were ready for actual facilitation. Taking the time to ensure that the skill-level of the simulation appropriately reflected the incoming skill-level of the participants helped to make the simulation more effective, practical, and enjoyable for all involved.

Likelihood of Successful Learning Outcomes

Ultimately, the goal upon completion of Stage Three is to have a finished, working simulation or game that has a reasonable likelihood of producing a successful learning outcome. Therefore, this is the final verification that must be conducted to ensure the developer has created a practical and fully functioning simulation.

The learning objectives and achievement thereof were assessed at the conclusion of the test-run by discussing each group's "BLUF" report and each participant's responses to the SATs used in the exercise. Exposure and practice are the driving objectives of this simulation, and the evaluation criteria to measure that was determined to be an end-of-exercise discussion about the application of the tools and how they affected each group's final analyses.

Collectively considering all the elements in the sample framework thus far, as well as the few necessary revisions, it was determined that there would be a reasonable likelihood of achieving and substantially measuring successful learning outcomes during facilitation.

Stage Four: Facilitate, Evaluate, and Revise

The fourth and final stage of the framework used to develop “The Smithmine Explosion” analytic exercise included facilitating, evaluating, and revising the simulation. At this point the exercise has become a functional tool that can be used repeatedly in various circumstances to introduce novice participants to some key concepts of intelligence analysis. However, evaluation and revision are constant practices that must be incorporated as technology advances, new techniques are established, and threat landscapes continue to evolve. The process of simulation development varies for all developers, as there is no one set way to build an effective engagement. Thus, Stage Four is an ongoing process that emphasizes how simulations must be maintained and continually updated to best reflect the reality they were designed to represent. At any point, the developer may return to a previous stage to modify some aspect of the simulation, whether it is the type of SATs used, the narrative context, or supporting analytic products. The unique flexibility of simulation development through this sample structure is best represented in this stage, as a completed simulation could easily expand into a slightly different version of the current work to best fit the learning objectives, theme, or restraints of a given training environment.

Chapter 4

Conclusion

Ultimately, this thesis sought explore how serious games can mitigate challenges associated with the timely and accurate analysis of complex intelligence, understand the educational underpinnings that support active-learning strategies to enable higher-level thinking, and create an engaging and effective analytic exercise based on a structured framework to supplement the myriad of resources available to aspiring intelligence professionals.

To address the intelligence problem, structured analytics were recognized as a potential solution, specifically targeting aspiring intelligence professionals in an educational setting. By jointly utilizing traditional and active-learning strategies, such as lecture and serious games, intelligence aspirants will be presented key concepts from a variety of perspectives and learn from experiences of their own.

Yet, there are still drawbacks to utilizing simulation and games, particularly in terms of construction and feasibility. To address these and other challenges, several consistent aspects in the development process from prominent literature were compiled and the resulting principles contributed to a four-stage framework that helped guide the construction of an original analytic exercise in support of Penn State's College of IST Undergraduate Recruitment and Student Engagement programs.

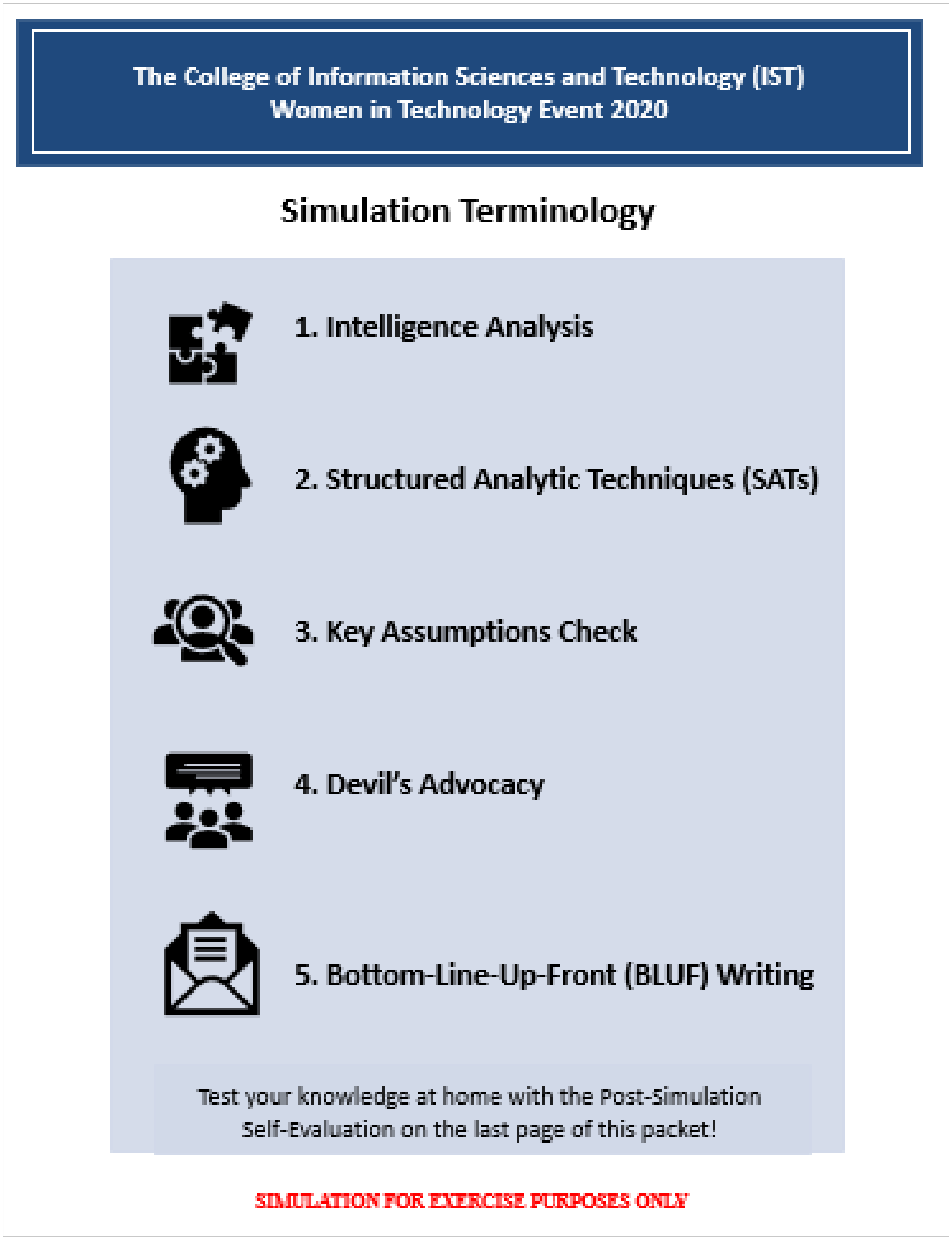
An evolving threat landscape increases pressure for the IC to maintain a competitive analytic edge. Through methods such as simulation and gaming, future generations may be effectively inspired and trained to pursue a career in intelligence to combat the complex challenges that will continue to threaten US national security.

Appendix A

"The Smithmine Explosion" Analytic Exercise: Resource Packet

This appendix contains all the exercise documents needed to run "The Smithmine Explosion" analytic exercise.

Figure A1 depicts the first page of the resource packet for participants. **Figure A2**, **Figure A3**, and **Figure A4** show the next few pages of the resource packet detailing specific terminology used in the simulation. **Figure A5** shows the post-simulation self-evaluation that the participants can complete at home after the exercise session.



The College of Information Sciences and Technology (IST)
Women in Technology Event 2020

Simulation Terminology

1. Intelligence Analysis
2. Structured Analytic Techniques (SATs)
3. Key Assumptions Check
4. Devil's Advocacy
5. Bottom-Line-Up-Front (BLUF) Writing

Test your knowledge at home with the Post-Simulation Self-Evaluation on the last page of this packet!

SIMULATION FOR EXERCISE PURPOSES ONLY

Figure A1: Participant resource packet page 1

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Simulation Terminology and Additional Resources

Intelligence Analysis

Intelligence analysis is the process of organizing information in a certain way that allows a decision-maker to understand the visible or hidden implications and impact associated with a person, organization, entity, or event.

Intelligence

A specific type of information that meets decision-makers' needs. This information is collected, processed, and analyzed to meet those requirements. There are many types of intelligence used different ways for a number of purposes.

Example: *Geospatial Intelligence* (a.k.a. GEOINT) is collected using satellites to gather images of people, places, things, and events on the Earth.

Interested in learning more?
Check out these resources:

- *Intelligence: From Secrets to Policy* (8th Edition) by Mark M. Lowenthal
- *Strategic Warning: If Surprise is Inevitable, What Role for Analysis?* by Jack Davis
- The Analyst Toolbox (https://www.ialeia.org/docs/analyst_toolbox.pdf)

Structured Analytic Techniques (SATs)

SATs are a series of approaches or "best practices" used to help promote collaboration, formulate alternative hypotheses, and manage conflicting information. Using SATs also helps lessen the effects of implicit biases or heuristics that may influence an analyst's interpretation of a situation.

Interested in learning more?
Check out these resources:

- *Cases in Intelligence Analysis: Structured Analytic Techniques in Action* by Sarah Miller Beebe & Randolph H. Pherson
- *Structured Analytic Techniques for Intelligence Analysis* by Randolph H. Pherson & Richards Heuer
- A Tradecraft Primer by the U.S. Government
- *Forecasting Terrorism: Indications of Proven Analytic Techniques* by Sundri Khalsa

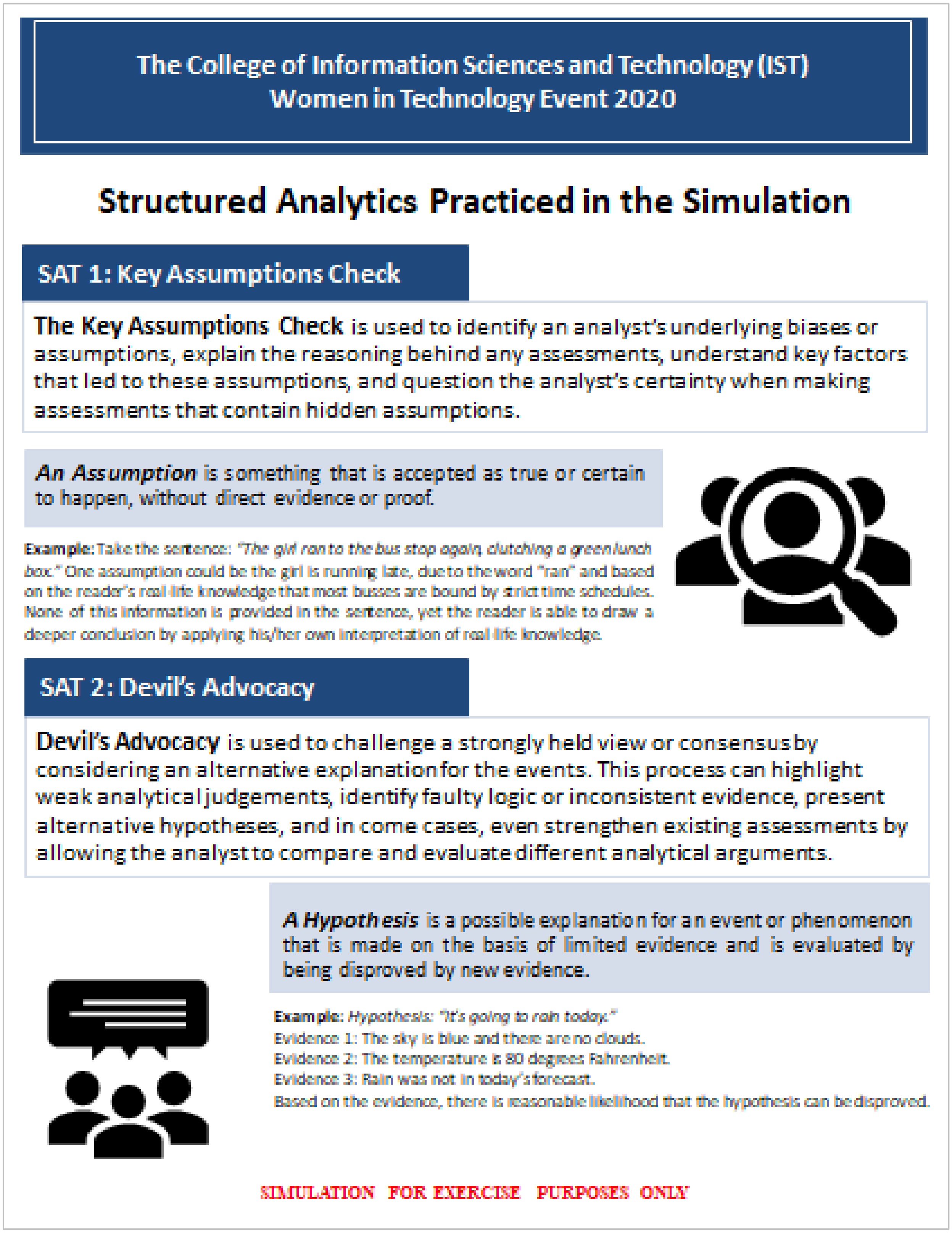
Implicit Biases or Heuristics

Beliefs, often not consciously recognized, that influence people's decisions and shape the way an individual views the world.

Example: *Confirmation Bias* is one type of bias that occurs when an individual seeks out or uses certain evidence to support an existing belief and ignores other information that does not support or effectively opposes this belief.

SIMULATION FOR EXERCISE PURPOSES ONLY

Figure A2: Participant resource packet page 2



The College of Information Sciences and Technology (IST)
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Structured Analytics Practiced in the Simulation

SAT 1: Key Assumptions Check

The Key Assumptions Check is used to identify an analyst's underlying biases or assumptions, explain the reasoning behind any assessments, understand key factors that led to these assumptions, and question the analyst's certainty when making assessments that contain hidden assumptions.

An Assumption is something that is accepted as true or certain to happen, without direct evidence or proof.

Example: Take the sentence: *"The girl ran to the bus stop again, clutching a green lunch box."* One assumption could be the girl is running late, due to the word "ran" and based on the reader's real-life knowledge that most busses are bound by strict time schedules. None of this information is provided in the sentence, yet the reader is able to draw a deeper conclusion by applying his/her own interpretation of real-life knowledge.

SAT 2: Devil's Advocacy

Devil's Advocacy is used to challenge a strongly held view or consensus by considering an alternative explanation for the events. This process can highlight weak analytical judgements, identify faulty logic or inconsistent evidence, present alternative hypotheses, and in come cases, even strengthen existing assessments by allowing the analyst to compare and evaluate different analytical arguments.

A Hypothesis is a possible explanation for an event or phenomenon that is made on the basis of limited evidence and is evaluated by being disproved by new evidence.

Example: *Hypothesis: "It's going to rain today."*
Evidence 1: The sky is blue and there are no clouds.
Evidence 2: The temperature is 80 degrees Fahrenheit.
Evidence 3: Rain was not in today's forecast.
Based on the evidence, there is reasonable likelihood that the hypothesis can be disproved.

SIMULATION FOR EXERCISE PURPOSES ONLY

Figure A3: Participant resource packet page 3

The College of Information Sciences and Technology (IST)
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Analytic Writing or "BLUF" Writing

Bottom Line Up Front (BLUF)

The Analytic, or "BLUF", writing style is different from traditional academic writing. Analysts must take complex ideas, identify relationships between numerous pieces of information, and translate these findings into clear, concise, and simple written and verbal deliverables.

"Bottom Line Up Front" means that an analyst will lead their reports with an assessment of the situation first, followed by supporting information. This allows the reader to immediately understand the message.

This style of writing can be simplified into three parts:

1. **The Issue** (What happened?)
2. **The Effects** (So what? Why do we care?)
3. **The Impact** (What does this mean? What can we do about it?)

Interested in learning more?
Check out these resources:

- *Analytic Writing Guide* by Louis M. Kaiser & Randolph H. Pherson
- "Critical Writing and Thinking Skills Are Vital for Intelligence" (https://inhomelandsecurity.com/writing-thinking-intelligence-analysts/)
- The Analyst's Style Manual (https://www.ncirc.gov/documents%5Cpublic%5CAnalysts_Style_Manual.pdf)

SIMULATION FOR EXERCISE PURPOSES ONLY

Figure A4: Participant resource packet page 4

The College of Information Sciences and Technology (IST)
Women in Technology Event 2020

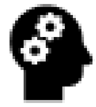
Post-Simulation Self-Evaluation

Test your knowledge!

Try to define the following terms we used in the analytic exercise without using the reference materials. Once you complete your responses, check your answers and see how you did! If you're interested in learning more about intelligence analysis or the Security and Risk Analysis degree program, check out the additional resources found in the reference materials worksheets.

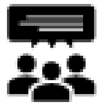
1. Intelligence Analysis

2. Structured Analytic Techniques (SATs)



3. Key Assumptions Check

4. Devil's Advocacy



5. Bottom-Line-Up-Front (BLUF) Writing

SIMULATION FOR EXERCISE PURPOSES ONLY

Figure A5: Participant resource packet page 5

Appendix B

"The Smithmine Explosion" Analytic Exercise: Background and Intelligence

This appendix contains all the background and intelligence documents needed to run "The Smithmine Explosion" analytic exercise. All of these documents are completely fictional and intended only for use in the context of this exercise. Any resemblance to actual people or events is completely coincidental and unintentional.

Figure B1 shows the first page of the Background document which gives the participants the context needed to solve the exercise's problem. **Figure B2** shows page two of the Background. **Figure B3** and **Figure B4** show pages one and two, respectively, of the first piece of intelligence, an open source news report. **Figure B5** shows the second piece of intelligence, on-duty security staff profiles. **Figure B6** depicts a series of maintenance reports for the Cityville Convention Center, and **Figure B7** shows a suspicious social media page.

The Smithmine Explosion
An Exercise in Applying Structured Analytic Techniques

BACKGROUND INFORMATION:

YOUR ROLE:

You and your teammates are members of the new Joint Terrorism Task Force (JTTF) established by the Federal Bureau of Investigation (FBI) to assess whether an act of terrorism is the most likely explanation for the explosion and resulting fire that occurred at the Cityville Convention Center on 19 March, during the first evening of the three-day Smithmine Convention, the largest collaborative event on natural resource extraction in the country.

SMITHMINE CONVENTION BACKGROUND:

The explosion originated in the largest showroom, Diamond Hall, where the keynote speaker from one of the leading offshore mining corporations was scheduled to present on Day Two of the event. The Smithmine Convention has been held here at the Cityville Convention Center annually for the last 39 years, showcasing advancements in enhanced oil recovery techniques from leading corporations world-wide that engage in resource mining activities, such as multi-stage drilling and hydraulic fracking. Fracking is a process by which layers of stone and rock miles beneath the earth's core are fractured and destroyed in order to attain oil and petroleum reserves that may be hidden beneath Earth's thick layers. In recent years, the Cityville Convention Center elected Board of Directors has requested the inclusion of several presentations on the future of renewable energy sources in response to increased radical-environmentalist activity against the Smithmine event itself across the nation.

CITYVILLE CONVENTION CENTER BACKGROUND:

The Cityville Convention Center is located near the center of the highly populated town of Cityville. Many of the town's citizens earn their annual incomes from working in the petroleum crude oil refinery where the natural gas is processed and purified before distribution and consumption. Since the facility was established nearly eleven years ago, Cityville has experienced a revitalized economy from this surge of employment opportunity. Expanding fracking efforts across the country has become the petroleum industry's next objective in response to energy consumers' increasing demand, both in the commercial and government sectors, with over two-thirds of the natural gas and one-third of the oil production in the country stemming from these efforts.

MAINTENANCE ISSUES WITH CITYVILLE CONVENTION CENTER:

Within the last two months, the Cityville Convention Center has received numerous warnings and a handful of citations from city inspectors due to the center's failure to ensure the building's adherence to city code. Specifically, inspectors have cited the center for faulty plumbing, HVAC issues and electrical wiring exposures and instability. These issues have also been recognized by guests and events in the Emerald Room and the Diamond Hall over the last two months and recorded in separate incident reports. Funding allocation for maintenance repairs had been pending the Board of Directors' approval at the time of the explosion.

ECO-TERRORISM BACKGROUND:

There have also been rising opposition to fracking and resource mining, such as gas and oil drilling, by radical environmentalists, or "eco-terrorists", who have banded together in

SIMULATION FOR EXERCISE PURPOSES ONLY   1 of 2

Figure B1: Background information, page 1 of 2 retaliation against the commercialization and rapid depletion of Earth's natural resources. Officially, the FBI defines eco-terrorism as "the use or threatened use of violence of a criminal nature against innocent victims or property by an environmentally-oriented, subnational group for environmental or political reasons, or aimed at an audience beyond the target, often of a symbolic nature." From 2003 to 2008 alone, eco-terrorism caused nearly $200 million in property damages in the US.

OPPOSITION GROUP TACTICS AND CAPABILITIES BACKGROUND:
High-level threat organizations the FBI is currently keeping tabs on include the Earth Liberation Front (ELF), the Animal Liberation Front (ALF), and the Anti-Fracking Alliance (AFA). Some common tactics used by these organizations include "tree spiking", which is when metal spikes are inserted into trees to damage de-forestation equipment, "monkeywrenching", which are acts of sabotage or property destruction against industries or individual entities who may be causing damage to the environment, arson, or bombing. The objective of these organizations is not necessarily to harm human beings; however, things of great economic or symbolic importance to powerful entities may serve as a valuable target.

These organizations have sophisticated planning and intelligence gathering methods of their own, and members of these organizations have been known to conduct photographic/video surveillance about potential targets, maintain up-to-date knowledge about industry events and technological advancements, as well as distributing information about vulnerable targets on social media and organization websites.

YOUR TASK FORCE'S OBJECTIVE:
In addition to the information provided above, you will be given four (4) pieces of intelligence to use to prepare a detailed report on the situation.

Consider the following questions as you work through the exercise:

1. What caused the explosion?
2. Is there any reason to assess that an act of terrorism caused the explosion?
3. Is there any reason to assess that an act of terrorism did not cause the explosion?
4. Who or what is responsible for the explosion?
5. What are the immediate effects of the explosion?
6. What is the significance of the explosion? Why is the explosion important?
7. What are possible next steps in the investigation if terrorism was involved? What if terrorism was not involved?

NOTE: Nothing in the evidence provided solely or immediately indicates that this event was or was not an act of terrorism. You will have to utilize Structured Analytic Techniques (SATs), discuss all possible explanations, and effectively work with your teams to solve this analytic problem. Be sure to ask the facilitators for help if you have any questions!

Figure B2: Background information, page 2 of 2

INTEL REPORT 1: OPEN-SOURCE NEWS REPORT

The Cityville Gazette

Sudden Explosion Rocks Largest National Fracking Convention

March 19, 2020

An explosion took place this evening around approximately 7:45pm at the Cityville Convention Center just as the Smithmine Convention, the largest annual gathering of oil and gas tycoons in the nation, was concluding its first night of activities.

A Fractured Opportunity

Over 300 global oil and gas corporations were slated to attend or present throughout a series of seminars over the course of this three-day event, with the entire conference leading up to a presentation of a newly designed prototype for massive hydraulic fracking developed by Mr. James McAllister, a foundering partner of the leading off-shore mining firm, McAllister and Co. Sources confirmed the prototype was an advanced piece of petroleum extraction equipment to enable faster, more efficient, and cheaper natural resource collection efforts worldwide.

Scores of protesters lined the streets surrounding the convention center as guests and presenters arrived earlier today, reportedly challenging the implementation of the new prototype and well-known firms like McAllister and Co. profiting from prolonging dependence on non-renewable energy sources. Although the protests were generally peaceful, one protester apparently felt their signs and chanting were not enough to make their message heard. For "those money-hungry corporations" to "wake up and stop destroying the only planet we have",

Photo of the Cityville oil refinery facility

explained long-time environmental activist, Rodney Adams, "one of these days, someone's gonna have to hit them where it hurts the most".

The Diamond Hall Destroyed

Local authorities reported the blast destroyed over one-third of the conference center, but the real source of damage was the blazing fire that emergency response teams are still working to completely extinguish. First responders identified the source of the blast was in the mechanical room, beneath the Diamond Hall, near the basement storage facilities and security office. All the guests were in the Grand Ballroom at the opposite end of the building to hear the evening's closing remarks. Although no one was in the Diamond Hall at the time of the explosion, the entire building was evacuated due to the intense flames.

Miraculously, there were no casualties, but 15-20 people, mostly staff working in the

(continued on page 2)

Figure B3: Intelligence 1: Open source news report, page 1 of 2 lower level of the convention center in the mechanical room were seriously injured as a result of initial impact and falling rubble. They were able to escape further injuries by using the service entrance adjacent to the mechanical room.

It seems the Diamond Hall is where McAllister's prototype was on display, and unfortunately, the equipment has been severely damaged. McAllister's formal presentation and national rollout of the modernized petroleum extraction equipment have been postponed indefinitely, costing McAllister and Co. hundreds of thousands of dollars in damages.

A Nefarious Plot or Negligent Oversight?
Authorities have announced it is unclear if the explosion was the result of an accidental technical failure or some intentional act of terrorism. The building itself was recently cited by city inspectors within the last two months for not keeping up with necessary renovations and maintenance work in accordance with city-wide regulations.
Paul Maubroke, a senior member of the Cityville Convention Center staff, was not completely shocked when he felt the initial impact of the explosion this evening, stating that some members of the board have been "hard pressed for a while to allocate enough funds toward updating the facilities, including some of our critical infrastructure like the plumbing, HVAC, and electric, that we need to actually be able to run [the convention center]". The falling debris from the convention center cascaded into a nearby power line, which has left both the convention center and hundreds of Cityville citizens without power.

"It was a classic oversight that came back to bite us all in the end," Maubroke mused bitterly. "Maybe now they'll change their minds and open their pocketbooks." More updates to come as the situation unfolds.

Figure B4: Intelligence 1: Open source news report, page 2 of 2

The Smichmine Explosion
An Exercise in Structured Analytic Techniques

INTEL REPORT 2: On-Duty Security Staff Profiles

Security Personnel On-Duty on 19 March

Employee Name	Age	Hiring Date	Role
Baker, Margaret	23	6 February 2020	Assistant Security Personnel
Notten, Alice	41	7 July 2006	Director of Internal Security and Operations
Waters, Daniel	29	5 August 2017	Assistant Security Personnel

Cityville Convention Center Security Staff Roles and Responsibilities

Role: Director of Internal Security and Operations
Duties include:

- **General Management**
  - Providing employees with necessary tools and information to efficiently and successfully understand potential threat actors and implement appropriate safeguards
- **Documentation and Recordkeeping**
  - Maintaining close record of all reported incidents and disturbances
  - Addressing security vulnerabilities with appropriate responses
- **Training and Development**
  - Ensuring all employees are properly trained on security and emergency management protocol in response to all levels of threat (high, moderate, low)
  - Providing opportunities for employees to increase their security-related knowledge and abilities by exposing employees to a variety of tasks and responsibilities.

Role: Assistant Security Personnel
Duties include:

- **Surveillance**
  - Physical patrolling around the building, including the hallways, seminar rooms/conference halls, parking lots, on-site maintenance facilities;
  - Audio/Visual surveillance via security cameras in the Security Office
- **Escorting Guests and Maintaining Order**
  - Helping direct presenters to the correct seminar rooms or conference halls
  - Using available building and event maps to assist guests or audience members in finding their ways around the center
  - Handling any disturbances or addressing unruly guests
- **Regular Reporting to Head of Security**
  - Identifying and reporting all suspicious activity

SIMULATION FOR EXERCISE PURPOSES ONLY 1 of 1

Figure B5: Intelligence 2: On-duty security staff profiles, page 1 of 1

The Smithmine Explosion
An Exercise in Structured Analytic Techniques

INTEL REPORT 3: Cityville Convention Center Maintenance Reports

Cityville Convention Center
Maintenance Report

Date: 14 January 2020
Time: 2:14 PM
Report No. 5924-21

Requester: Alice Notten
Report Type: Maintenance Request - Electrical
Issue: Faulty electrical wiring in the Emerald Room
Status: Resolved

Description:
Several guests have been complaining to convention center staff members about a burning odor in the Emerald Room, like something heating up for too long. Can we dispatch a maintenance team to the Emerald Room to check this out?

Resolution:
After receiving the third complaint on 14 January, security evacuated the room and a maintenance team was dispatched to investigate. The team discovered old electrical wiring in the room that seemed to be torn in several places, causing the burnt smell. The conference refrained from using the Emerald Room while an electrician was called to take care of the faulty wiring in the room.

Comments:
The electrician noted that even though the wiring in the Emerald Room seemed resolved, there may be additional issues throughout the building, which hasn't been renovated in over 30 years. The rest of the center should at least be inspected for electrical concerns within the next three months to avoid future concerns.

Cityville Convention Center
Maintenance Report

Date: 12 February 2020
Time: 4:34 PM
Report No. 5989-21

Requester: Alice Notten
Report Type: Maintenance Request - Mechanical
Issue: Strange noises coming from the Mechanical Room
Status: In-Progress

Description:
One of my Assistant Security Personnel reported to me that she was approached by two different guests attending a conference in the Diamond Hall who said they heard strange noises that seemed to be coming from the vents around the room. Could this be related to the wiring issue we saw last month? I've also heard some noises coming from the Mechanical Room even when I'm working across the hall in the Security Office. Margaret and I will be in the Security Office this evening if someone needs more information from her about the issue.

Comments:
Issue currently under observation and awaiting board expenditure approval.

SIMULATION FOR EXERCISE PURPOSES ONLY

1 of 1

Figure B6: Intelligence 3: Cityville Convention Center maintenance reports, page 1 of 1

Figure B7: Intelligence 4: A suspicious social media page, page 1 of 1

Appendix C

"The Smithmine Explosion" Analytic Exercise: Analytic Worksheets

This Appendix contains all the analytic worksheets needed to run "The Smithmine Explosion" analytic exercise. All of these documents are intended only for use in the context of this exercise.

Figure C1 shows page one of the Evidence Tracker worksheet, while **Figure C2** shows page two. **Figure C3** depicts the worksheet containing the SATs, Key Assumptions Check and Devil's Advocacy. **Figure C4**, **Figure C5**, and **Figure C6** show pages one, two, and three of the deconstructed final BLUF template.

The Explosion at Smithmine: An Exercise in Applying Structured Analytic Techniques
March 21, 2020

Keep Track of the Evidence

As you read each intelligence report, use the table below to list any evidence that could contribute to either hypothesis. Cite the intelligence report in which you found the evidence.

Task Force Mission: Determine whether terrorism played a role in the explosion at the Smithmine Convention at the Cityville Convention Center on 19 March 2020.

Possible Hypotheses:	
Terrorism was involved	**Terrorism was not involved**
Example: Perfect timing - the new fracking prototype just happened to be destroyed the night before the equipment was planned to be revealed (Report 1)	**Example:** Security guard reported strange noises coming from the vents in the Diamond Hall that could have been related to electrical wiring issues (Report 3)

SIMULATION FOR EXERCISE PURPOSES ONLY

1 of 2

Figure C1: Evidence Tracker Page 1 of 2

The Explosion at Smithmine: An Exercise in Applying Structured Analytic Techniques
March 21, 2020

Possible Hypotheses: (Continued, if needed)	
Terrorism was involved	**Terrorism was not involved**

SIMULATION FOR EXERCISE PURPOSES ONLY

2 of 2

Figure C2: Evidence Tracker Page 2 of 2

The Explosion at Smithmine: An Exercise in Applying Structured Analytic Techniques
March 21, 2020

Key Assumptions Check:

Check the Key Assumptions in your responses. Answer the following questions:

1. Did terrorism play a role in this event?

☐ Yes ☐ No **Rate your confidence level (1-5):** ____________

a. Discuss your response with your team using the evidence you identified from the intelligence to support your view.

Example: If you think terrorism did not play a role in this event, talk about the key evidence in the intelligence reports that led you to that assessment.

b. With your team, use the evidence you identified from the intelligence to brainstorm how the cause of the explosion could have been the **opposite** of your initial assessment. **(Devil's Advocacy)**

Example: If you think that terrorism was involved in the event, look for evidence in the intelligence reports and discuss with your team how you could argue that terrorism was not involved.

2. Is there anyone (individuals, organizations, entities, etc.) who could be responsible for the cause of the explosion/fire?

☐ Yes ☐ No **Rate your confidence level (1-5):** ____________

c. Discuss your response with your team using the evidence you identified from the intelligence to support your view.

Example: If you think there is an individual or organization (or several) that could be responsible for the event, discuss key evidence in the intelligence reports that led you to that assessment.

d. With your team, use the evidence you identified from the intelligence to brainstorm how the cause of the explosion could have been another individual, organization, or entity's responsibility. **(Devil's Advocacy)**

Example: If you think that a certain entity was responsible for the event, look for evidence in the intelligence reports and discuss with your team how you could argue that this entity was not responsible.

SIMULATION FOR EXERCISE PURPOSES ONLY 1 of 1

Figure C3: Key Assumptions Check and Devil's Advocacy

The Explosion at Smithmine: An Exercise in Applying Structured Analytic Techniques
March 21, 2020

Final BLUF Report:

Team Members:

1. **State the ISSUE (What happened?)**
   a. What was the event?

   b. Where and when did the event take place?

   c. Who/what caused the event?

   d. How did the event happen? (Who did what where?)

BLUF Part 1: Now, combine the above information into one or two sentences:

SIMULATION FOR EXERCISE PURPOSES ONLY

1 of 3

Figure C4: Deconstructed final "BLUF" page 1 of 3

2. State the EFFECTS (So what? Why do we care that this happened?)

a. What are the physical effects of the event?

b. What are the reputational effects of the event?

c. What are the financial effects of the event?

d. Any additional effects? (i.e. security, social, environmental, etc.)

BLUF Part 2: Now, combine the above information into two or three sentences:

Figure C5: Deconstructed final “BLUF” page 2 of 3

The Explosion at Smithmine: An Exercise in Applying Structured Analytic Techniques
March 21, 2020

3. State the IMPACT (Now what? Why is all of this important?)

a. What is the objective of your task force?

b. Is there enough evidence to suggest that terrorism played a role in this event? Why or why not?

c. Based on your assessment above, what recommendations can you provide for the next steps in the investigation?

BLUF Part 3: Now, combine the above information into two or three sentences:

4. **Finally, it's time to put it all together –** Nominate one person from your team to share your three-part BLUF aloud with the rest of the group.

SIMULATION FOR EXERCISE PURPOSES ONLY

3 of 3

Figure C5: Deconstructed final "BLUF" page 3 of 3

Appendix D

Sample Development Framework: “The Smithmine Explosion”

Table D1 depicts the sample simulation development framework that was used to guide the construction of “The Smithmine Explosion” analytic exercise.

Table D1: Sample Development Framework: "The Smithmine Explosion"

Sample Development Framework: "The Smithmine Explosion"
Stage 1: Select the Type of Simulation
Identify a Theme: • Ecoterrorism • Structured Analytic Techniques (SATs) • Analytic “BLUF” Writing
Characterize Learning Objectives: • Understand how to use SATs to approach an analytic problem. • Practice using concise, “BLUF” writing to present a written analytic deliverable.

Assess Relevant Constraints:
• Capital
    o No funding is necessary, as all construction and facilitation materials used for this project are from available sources through Penn State or otherwise.
• Size and Scale
    o This project will take place in a one (1) hour-long session.
    o A minimum of three (3) facilitators are needed for a group of approximately thirty (30) participants.
• Collaborator(s)
    o There will be one (1) primary developer on this project.
    o Advisors with experience in developing simulations and analytic exercises will be consulted for feedback on simulation quality and practicality.
    o Several members of the College of IST Undergraduate Recruiting and Student Engagement staff will be consulted for feedback on appropriateness for the intended audience.
• Materials
    o For construction:
        ▪ Laptop/PC (personal)
        ▪ Box Cloud Storage (provided as a Penn State student)
        ▪ Microsoft Office Suite (provided as a Penn State student)
    o For facilitation:
        ▪ Reference Documents detailing all terms used in the simulation (hard copy and digital)
        ▪ Simulation Background Document (hard copy and digital)
        ▪ Message Traffic (4 pieces of information from varying sources) (hard copy and digital)
        ▪ Analytic Worksheets with instructions for using each SAT (hard copy and digital)
        ▪ Post-Simulation Self-Evaluation (hard copy and digital)
        ▪ PowerPoint Presentation with speaker notes (digital)
• Schedule and Deadlines
    o All deadlines associated with Schreyer Honors Thesis requirements must be followed.
    o The first exercise test-run will take place one month before the event date.
    o Volunteer/Co-facilitator training will take place one week before the event.

- Formal facilitation is scheduled take place on March 21, 2020, as part of a College of IST-sponsored event.

- Theme and Learning Objectives
  - Participants' prior knowledge of simulation concepts is assessed to be minimal; therefore, resource materials and an overview of key terminology must be included in the final exercise package.
  - A 15-minute overview of key terminology is required for the facilitator's introductory brief.
- Anticipated Likelihood of Success
  - The greatest risks include allotting sufficient time to complete each task and participant motivation to engage. This will be addressed in narrative and simulation materials development in Stage 2.
  - Participants will be divided into teams of two (2) to four (4) people.
  - No outside resources are required for the exercise, as all materials will be provided in the simulation packet.

Stage 2: Design and Construct

Conduct Initial Research:

- Types of SATs appropriate for the participants' skill-levels. Selected SATs include Key Assumptions Check and Devil's Advocacy.
- Elements of ecoterrorism, such as active and historical organizations, communication strategies, frequent tactics, and common targets.
- Realistic message formatting from relevant information sources.

Develop a Narrative:

- An explosion occurred at the Cityville Convention Center during the Smithmine Convention, the largest annual natural resource extraction convention in the United States.
- Participants will take on the role of an FBI Joint Terrorism Task Force (JTTF) to determine if and how terrorism might have been involved in this disastrous event.
- The JTTF must provide a BLUF-style analytic brief to decision-makers detailing their findings of the investigation, based on a series of collected intelligence.

Prepare Supporting Materials:

- Background and Supporting Documents
  - Participant Role/Background
  - Intel 1: Local News Report on the Explosion
  - Intel 2: On-Duty Security Staff Profiles
  - Intel 3: Cityville Convention Center Maintenance Reports
  - Intel 4: Suspicious Facebook Profile
- Analytic Worksheets
  - Evidence Tracker
  - Key Assumptions/Devil's Advocacy
  - Final BLUF Step-by-Step Guide
- Key Terminology Resource Documents
  - Intelligence Analysis
  - Structured Analytic Techniques
  - Key Assumptions Check
  - Devil's Advocacy
- BLUF/Analytic Writing Facilitator and Volunteer Materials:
  - Exercise Timeline
  - Volunteer Roles and Responsibilities
  - Facilitator Presentation and Speaking Notes
  - Full Narrative – Key
  - Evidence Tracker – Key
  - Analytic Worksheets – Key

Establish Evaluation Criteria:

- This simulation is an exploratory exercise that does not require explicit criteria to be met, other than simply adhering to the analytic worksheets and participating the process of applying SATs.
- After participants complete the simulation, they will have the option to complete a self-evaluation on their own time, as part of their take-home resource packets, to test their knowledge of simulation terms.

Stage 3: Test, Evaluate and Revise:

Clarity:

- Deconstructed "BLUF" template tailored to the exercise was particularly useful for novice participants with no experience in analytic writing.
- Simple narrative design and task structure, despite four pieces of intelligence with both relevant and irrelevant information.
- Test-run feedback indicated clear relationships among learning objectives, relevant real-world contexts, and immediate task expectations.

Feasibility:

- Capitol:
  - No issues with the current budget; unlikely that there would be any additional expenses at this point.
- Size and Scale:
  - Supporting roles were assigned (i.e. Volunteers vs. Co-facilitators)
- Collaborators:
  - Supervisors and co-workers in the College of IST assisted with the test-run and helped determine supporting roles for final facilitation.
- Materials:
  - Nearly all materials are documents that have been compiled into an exercise packet. The other materials needed are a computer, projector, writing utensils, and desks for participants. After the test-run, further assessment found that attaining these materials for final facilitation is feasible.
- Schedule and Deadlines:
  - The feedback from the test-run did not take simulation progress off-track to be completed by any of the deadlines (Schreyer or event date).
- Overall Use:
  - The feedback from the test-run indicated this exercise would be a feasible addition to the resources and event activities currently used by the College of IST.

Preparation:

- Simulation Materials:
  - All simulation materials were accounted for and prepared at this stage in development. Small cosmetic revisions were required (i.e. formatting, grammatical errors, visual preference).
  - Multiple methods of accessibility were considered and enabled (i.e. digital vs. hard copy).
- Participants:
  - Test-run participants ranged from those who had little knowledge of analytic terminology and theory to those who were full-fledged intelligence aspirants. The participants' feedback indicated the preparation materials were sufficient for the target participants with no experience, while also serving as an appropriate introduction for those who were more familiar with the concepts.
- Future Facilitator(s):
  - The materials required for this simulation are relatively minimal and packaged in a Box folder shared with future facilitators. The presentation/introductory brief is straightforward and requires a facilitator to have a moderate understanding of the terminology before running the exercise.

Likelihood of Successful Learning Outcomes:

- At the conclusion of the test-run, it was determined that a successful learning outcome would be indicated by each group's completed "BLUF" report and responses to the SATs used in the exercise.
- Considering the few necessary revisions and positive test-run feedback, there is a reasonable likelihood of achieving this successful learning outcome.

Stage 4: Facilitate, Evaluate, and Revise:
Continual Evaluation and Revision Efforts • Theme • Learning Objectives • Relevant Constraints • Additional Research • Further Narrative Development • Supporting Materials • Evaluation Criteria • Clarity • Feasibility • Preparation • Likelihood of Successful Learning Outcomes

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Education

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B.S. Security and Risk Analysis – Intelligence Analysis and Modeling; May 2020

Minor: Global Security; May 2020

Relevant Coursework:

The Intelligence Environment	Risk Analysis
Threat of Terrorism and Crime	International Relations
Deception and Counter-deception	Visual Analytics

Honors and Awards

Meyer Honors Scholarship	Dean's List
MacDonald Award in Material Science	Schreyer Honors College
J. W. Van Dyke Memorial Scholarship	UP 4 Year Provost Award
Student Engagement Network Grant (Summer 2018)	Outstanding Minor in Russian Studies

Work Experience

College of Information Sciences and Technology — *August 2019 – May 2020*

Intern, Office of Undergraduate Recruitment and Student Engagement

Grant Thornton LLP — *June 2019 – August 2019*

Intern, Public Sector Risk Advisory Services, Security and Privacy Review Team

The Pennsylvania State University — *March 2018 – August 2018*

Campus Liaison, Student Orientation and Transition Programs

Air Products and Chemicals Inc. — *May 2017 – August 2017*

Intern, IT Infrastructure

Leadership Experience and Activities

Red Cell Analytics Lab (RCAL)	Coordinator, 10th Anniversary Showcase: March 2019 Communications Officer: 2017-2019 General Member: 2016-2019
Penn State Women in Politics (WIP)	President: 2017-2018 Secretary: 2016-2017
Women in IST (WIST)	WIST Mentorship Program: 2019-2020 General Member: 2016-2020
National Security Club	General Member: 2019-2020

Additional Skills

Analytic: BLUF-style Communication, Critical Thinking, Problem-Solving, Structured Analytics

Technical: R, SQL, Java, ArcGIS, Analyst's Notebook, Tableau, Microsoft Office

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