REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
25-05-2021	Master of Military Studies (MMS) thesis	AY 2020-2021

4. TITLE AND SUBTITLE
Game Design Principles in Iran-Iraq War Game

5a. CONTRACT NUMBER
N/A

5b. GRANT NUMBER
N/A

5c. PROGRAM ELEMENT NUMBER
N/A

6. AUTHOR(S)
Maj Jessica Z. Wruck

5d. PROJECT NUMBER
N/A

5e. TASK NUMBER
N/A

5f. WORK UNIT NUMBER
N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
USMC Command and Staff College
Marine Corps University
2076 South Street
Quantico, VA 22134-5068

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
N/A

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
N/A

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

This paper analyzes and discusses the wargame principles applied in the "Iran-Iraq War" game. The intent is to discuss the futility of examining the Battle of Dezful from the Iran-Iraq War as an educational wargaming function.

15. SUBJECT TERMS
Wargaming; Iran-Iraq War; Dezful

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			USMC Command and Staff College
Unclass	Unclass	Unclass	UU	38	19b. TELEPHONE NUMBER *(Include area code)* (703) 784-3330 (Admin Office)

United States Marine Corps
Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068

MASTER OF MILLITARY STUDIES

GAME DESIGN PRINCIPLES IN *IRAN-IRAQ WAR* GAME

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

AUTHOR: MAJOR JESSICA Z. WRUCK, USAF

AY 2020-21

MMS Mentor Team and Oral Defense Committee Member:
CRAIG HAYDEN
Approved: _____
Date: 5/25/21

MMS ~~Mentor~~ Team and Oral Defense Committee Member:
PAUL GROSS
Approved: _____
Date: 5/25/21

United States Marine Corps
Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068

MASTER OF MILLITARY STUDIES

GAME DESIGN PRINCIPLES IN *IRAN-IRAQ WAR* GAME

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

AUTHOR: MAJOR JESSICA Z. WRUCK, USAF

AY 2020-21

MMS Mentor Team and Oral Defense Committee Member:
_____

Approved: _____
Date: _____

MMS Mentor Team and Oral Defense Committee Member:
_____

Approved: _____
Date: _____

Title: Game Design Implementation for *Iran-Iraq War*

Author: Major Jessica Z. Wruck, United States Air Force Reserve

Thesis: The Iran-Iraq War of the early 1980s offers a wargaming scenario that can be analyzed to focus game players on tank and maneuver warfare, logistics, and irregular warfare; this can be combined with the models of conflict resting on imperfect knowledge and terrain issues.

Discussion: Wargames are used as a critical educational tool to model and simulate warfare and military combat at the strategic, operational, and tactical levels. Using historical examples as models, wargames offer human interaction and decision-making in order to achieve learning outcomes. Furthermore, learning objectives can be shaped by the game designer to expand creative thinking. While wargaming is not strictly limited to providing analysis of a national security issue or episode, it can provide analytical insight into the realm of possibility and create a space for learning. The wargame scenario of *Iran-Iraq War* focuses on the Battle of Dezful, a four-day conflict that consisted of an Iranian offensive against Iraq. It was primarily a tank battle characterized by poor leadership, logistical support, and moderate air support. In essence, it was a modern battle fought with World War I tactics implemented poorly. The intent of the game design is to incorporate maneuver warfare, logistics, and irregular warfare with imperfect knowledge and terrain factors as models of conflict. The intent with *Iran-Iraq War* is to provide a tactical level wargame targeting NCOs and junior level CGOs to develop these considerations. Further drawing upon the studies of JFC Fuller and Liddell Hart in tank warfare and zones of control will expand upon these learning principles. Current US joint logistics models provide logistics theory for the game. Finally, some analysis of the risk versus the reward that a player may experience may also be helpful in examining the effectiveness of *Iran-Iraq War* as a tool for learning.

Conclusion: The design of *Iran-Iraq War* provides a portable and easy to learn game that incorporates the appropriate amount of chance to adequately facilitate creative learning about the tactical level of warfare. The game applies established design principles of educational wargaming to facilitate learning on maneuver, logistics, irregular warfare in the context of challenging terrain and imperfect information.

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

Illustrations

Page

Tables

Page

Table of Contents

Preface

This research project examined the development of an education wargame for an intended audience of NCOs and junior CGOs in an attempt to teach tank maneuver and logistics combined with imperfect knowledge and terrain considerations. This group used the Battle of Dezful during the Iran-Iraq War to model these concepts. An underlying and additional concept in developing this game was the consideration of possibilities during this conflict. Both Iran and Iraq possessed modern technology and capability that could have shown the world the realm of possibility if successfully employed. In essence, the Iran-Iraq War of the 1980s should have been a continuation of the lessons that were learned from the Yom Kippur War, however use of antiquated tactics and inept military leadership led to prolonged conflict. However, this did allow for flexibility in game development, since players can explore this battle within the realm of possibility. The intent in this paper is to give brief insight into the traditional elements of wargame design and touch on some military concepts and decision-making models that may also prove useful.

I would like to thank our MMS mentors, Doctors Hayden and Gelpi, Mr. Sebastian Bae, and my outstanding teammates, Maj Keith Toucey and Maj Kevin Stier.

Introduction

This paper introduces the concept of wargaming as an educational and analytical tool. To do this, the elements of a successful wargame will be introduced and explained. This paper then goes on to detail how aspects of the 1981 Battle of Dezful during the Iran-Iraq War are incorporated into the *Iran-Iraq War* wargame facilitate learning through careful design. This game aims to teach players the fundamentals of tank maneuver and logistics, drawing inspiration from mechanized military theorists such as JFC Fuller and Liddell Hart. This paper finally details game play, specifying game mechanics chosen for *Iran-Iraq War* and touching on statistical application in player decision making.

Wargaming Basics

Wargaming serves as a critical tool to model and simulate military combat at the strategic, operational, and tactical levels. Peter Perla defines wargaming as "a warfare model or simulation whose operation does not involve the activities of actual military forces, and whose sequence of events affects and is, in turn, affected by the decisions made by players representing the opposing sides."[1] While wargames have been popular with hobbyists, they are used in military settings to both generate insight through analytical games and to instruct; they educate in ways that no lecture or paper can accomplish by offering human interaction and decision-making without human sacrifice or palpable consequence. Furthermore, players can be placed in historical or real-world situations with a describable set of variables applicable to the given scenario.

The right wargame can offer a set of parameters in which players, as strategists or tacticians, can expand creative thinking. Games designed to generate insight or knowledge are known as *analytical games*. According to Perla, this does not imply that wargames can offer

solutions to problem, as he states "wargaming is not analysis" in the usual sense for national security settings.[2] However, they are analytical in that they provide insight into a stated problem. Wargames offer a tool for investigation, parameters for exploration into the realm of possibility.[3] While players can expect to use all available resources given to them in the game to make dynamic decisions, they can expect to be met with a dynamic opponent.[4]

One freeing and unique aspect to wargames is that they do not produce quantifiable data to explain outcomes. They produce "dirty data," outcomes that are not easily explained and the intent is not to reproduce a historical campaign.[5] Following this logic, wargaming is an art. However, wargames have scientific characteristics in that they still offer a method of applying military models and theories to achieve victory against an opponent. Essentially, wargaming is a blend of art and science.[6]

Wargames also provide valuable opportunities for experiential learning. Like analytical games, educational games can present players with opportunities to test out ideas and make important decisions that testing assumptions about conflict. Wargame designers facilitate learning by providing these kinds of experiences. This notion is solidified by detailed insight into why a course of action is chosen over others by breaking down human decision-making into probabilities, mathematical potentials, and incorporating game theory. Keying in on a player's decision space is so vital, that in developing a game, the creators must draw the line between accuracy and simplicity of a game to maximize a game's educational utility.

Educational wargaming is not unstructured learning. It is important to differentiate that wargaming is not brainstorming as it provides a level of competition that is not in parallel with brainstorming.[7] As Philip Sabin describes, "social scientists and historians face an even sharper trade-off between accuracy and simplicity, since human behaviour is far more complex and

unpredictable than that of an inanimate matter, and since controlled experimentation to investigate the impact of individual variables is much harder with human subjects."[8] To better conceptualize and translate this complexity into teachable objectives, wargames must incorporate models. A model, in context of a wargame, is a simulation.[9] A set of models is a combination of mathematical expressions and tables that translates the game's data and player decisions into game events.[10]

According to Perla, there are elements that every wargame should have to achieve some success: objectives, a scenario, a data base, models, rules, players, and, in some instances, analysis. All games have objectives, the targets that the game makers intend for players to hit; for hobbyist and commercially sold games the objective can be purely for entertainment and for professional settings the objective can be more refined and targeted. The level of definition of these objectives outlined by the game designers, sponsors, or analysists is critical to a game's success.[11] Some professional purposes of a wargame include concept development, capability development, senior leadership, support to operational plans, and training and education.[12] Concept development wargames consider new developments and technologies that could be implemented. Capability development wargames are those that are designed to provide input to defense budget and resource allocation. Senior Leadership wargames promote interaction and engagement amongst senior leaders to facilitate communication on strategic issues. Support to operational plans wargames evaluate the effectiveness of existing operational plans for Combatant Commanders to meet contingency requirements. These aforementioned analytical games generate new or relevant knowledge. However, training and educational games are developed to build a set of skills in players.[13]

The wargame scenario describes the setting and context that the game takes place. The scenario is key in that it is a vital contributor to setting the parameters and considerations that players must make in their decision making.[14] In the scenario, wargame designers may add constraints and determine the models of conflict, or the dynamics of warfare applicable to the situation presented. Designers may further choose the level of abstraction they wish to implement to reference the conflict, the constraints that may have been recognized at the time of the conflict, if a historical situation is emulated, or if constraints that should have been considered given other factors that were not readily apparent.[15] Games are designed around scenarios that can best facilitate learning particular concepts or competencies, and can be tailored to enable learning outcomes.

Both analytical and educational wargames require players to make decisions based on available information. In wargame design, the "*data base"* in wargaming refers to any information that will factor into the player's decision space. This can include the forces available to a friendly or opposing side and the measure of those forces' capabilities, environmental conditions, or any other information pertinent to an action taken on a turn.[16] Ease of access to this information is vital to the flow of gameplay, and game developers should avoid overcomplication. A bloated data base will slow a player's ability to understand his or her parameters and may distract from the objectives of the game.

The models of a wargame reference the levers and expressions that serve as translation of the players' decisions. This can be a combination of look-up tables, mathematical expressions, or point systems.[17] Just as many of the other of the other wargame elements must strike a balance between abstraction and detail, models must be flexible enough to allow sufficient player decision space, but comprehensive enough to cover unforeseen player decisions.[18] This is also

an opportunity to apply some chance to the game. Games that include an element of chance ensure that game results are not pre-determined, but rather encourage engagement (and learning) with the game. A game model that includes chance may also better represents conditions being taught about the real world. For the design of Iraq-Iran wargame, chance is incorporated with cards establishing advantages or disadvantages to each player.

Application of these models are implemented within the wargame rules, which establish the procedures of game play. The rules provide the appropriate level of boundaries to promote the objectives and should be delivered in the most efficient manner possible to facilitate ease of gameplay. The rules are also where some aspects of the database may be implemented. Peter Perla uses the example of simulating "the fog of war" through procedures detailed in the rules. In some cases, a game may have an umpire to monitor each player's actions and control information delivery.[19] This often simulates the revelation of information in warfare or the information flow that can result from successful intelligence gathering.

Finally, all wargames require human players to provide realistic decisions to facilitate game play.[20] Human players are a minimum requirement of successful educational wargames, even if all other elements are not fully defined; the interaction and decision space made by two opposing forces and must consider human mistakes. The flow of gameplay is affected by information and operational environmental factors that are provided to each player. It is the human players that provide any game analysis that is extracted from gameplay. The following section describes how elements of warfare are translated into the design of the Iran-Iraq educational wargame.

Iran-Iraq War **Wargame**

For *Iran-Iraq War*, the presented scenario takes place during the Iran-Iraq War of the 1980s, focusing on the Battle or Dezful, also known as the Battle of Susangard or Operation Nasr, which took place early in the eight-year conflict. In this scenario, the Iranians, fighting from a disadvantage, decided to launch an offensive against Iraq in the vicinity of the city of Dezful at a time when Iraqi President, Saddam Hussein, stated that Iraq would make no further advances into Iran. The two sides had ceased ground operations in favor of strategic targeting using air raids and artillery.[21] At the time of the Iranian offensive, Iraq had clearly gained the upper hand, garnering support from the West, making territorial gains and controlling the city of Khorramshahr in October of 1980. Defined as a heavy tank battle, it only lasted a few days and was considered a decisive Iraqi victory with Iran suffering heavy losses. Key considerations for this scenario are the terrain issues that were experienced by both sides, Iran decided to strike in January 1981, the rainiest time of the year and decided to flood the fields, causing issues for its own tanks. There were also intelligence gaps and spillages and logistical issues on both sides. In this game, the players must take terrain, logistics, and tank maneuver into consideration as part of the scenario. Victory conditions will also be modeled on the Battle of Dezful scenario.

Iran-Iraq War is two-player game, with one player playing as Iraq and the other playing as Iran. The objectives of the game are to expand tactical knowledge regarding mechanized movement and logistics. These elements of warfare are present in the game models, formalized in the game's combat engine, or how combat is resolved. The game allows players to take actions, which are then adjudicated with the output randomness, and unit maintenance costs and damage tracked with a point tracker. Randomness is the element of all games that can represent multiple aspects of war such as morale, probability, and fog of war; output randomness can use

tools such as dice to determine the success of a player action.[22] In *Iran-Iraq War,* output randomness will be controlled by a set of dice, one ten-sided and the other four-sided. These dice provide a level of probability that are important to each of their applications, which are detailed later in this paper. These design choices better present the realities of balancing maneuver, logistics, and informational concerns in the context of poor terrain.

At the beginning of the game, each player will draw six meeple, representing one battalion or division, at random from a pile of twenty-four. Each number on the meeple will correspond to the card which contains the information required for each unit. Each player will determine three units he or she wants to start with, and the subsequent three units will be brought in at the beginning of each day after. Additionally, each player will start with three cards: "Air Superiority," "Reconnaissance," and "Artillery." Each player will replenish these specific cards at the beginning of each turn, which represents one day of the battle.

The actual battle was a planned Iranian offensive, so Iran will go first at the start of the game and at the start of each day. Both players will be given an area where their six tank brigades may stage and begin their movements from. During a turn, each unit will be able to make three choices: they can move a specified number of hexes corresponding to the number and terrain on the unit card, attack an enemy unit if in range, or dig-in to their current position. Each card will also give that nation or unit some advantage or provide some disadvantage to the enemy, however once a card is used it is spent. The reason for this mechanic is to simulate the poor planning on behalf of both countries. Both Iran and Iraq had poorly maintained equipment, their aircraft were subject to mechanical failures. Iraq in particular was rapidly losing leadership as their military positions were abandoned frequently. The game design reduces this complexity into a simple mechanic.

Once the Iranian player has determined his or her action, the Iraqi player will then respond with one of the same three choices. Unit movement will be kept at a relatively abstract level, each unit will not have movement allowances based on capability. Each player is given a logistic zone in which they are free to move their units without incurring a fuel penalty for movement. If movement occurs outside of the logistic zone, the unit will lose one fuel piece. Should a player choose to attack, he or she must expend one ammunition piece. Once each player has expended its logistical resources or should both players choose to pass, the turn is over, and the "day" is complete. The players then replenish each unit's resources as annotated on the card and retrieves any expended cards. Additionally, each unit draws an additional chance card from the pile. As the Battle of Dezful was a four-day battle, the designers are attempting to allow for the players to complete all moves within the simulated four-days. At the end of the battle, Iran must have at least one unit within one hex of the town of Rofayyeh to achieve victory. If they are not able to do this, the player with the most units on the board will win. If both players have the same number of units on the board at the conclusion of the game, the country with the highest level of life will win. Level of life represents the measure of unit health and effectiveness for units deployed on the board.

The database for *Iran-Iraq War* will be comprised of twenty Iranian tank brigades, four Iranian armored divisions, and twenty-four Iraqi tank brigades. Capabilities are detailed by brigade and division according to tank type and weapon effects. Because terrain considerations are an objective to the game, this is a key environmental condition that will be built into the data base, as well as the use of roads and mechanized movement through desert terrain.

Why do wargames work? A good starting point to examine the efficacy of wargames as an educational tool is Malcom Knowles theory of andragogy, or the art and science of adult

learning.[23] In his theory, Knowles identifies several characteristics that attract adults in learning: immediacy of learning and the connection to application; items that impact their lives; problem-solving instead of content gathering; and experience as a foundation for learning.[24] In essence, adults are observed to gain knowledge from doing. This is reinforced by Russian psychologist Lev Vygotsky's observations that learning increases during socialization, in which thoughts and experiences can be shared and exchanged.[25] Wargaming offers both experience and socialization, which can be combined with a scenario or "synthetic experience."[26]

Using these laws of learning, game designers must apply the appropriate amount of stress on game players in attempt to further develop a given scenario that players can connect and interact with to prompt an "experience cycle" that was published by David Kolb. This experiential learning theory utilized a four-stage cycle of learning that modeled the cognitive process. In Kolb's experiential learning cycle's four steps consisted of: the concrete experience, the act of doing in order to have an experience; reflective observation, reviewing and reflecting on the experience had in the act of doing; abstract conceptualization, drawing conclusions and learning from the experience; and active experimentations, applying the lessons learned and planning based on them.[27] The idea is to motivate players through appealing games. A theme that is repeated by Curtiss Murphy is the idea of *flow* in a game, which can contribute to this motivation and promote intense focus on the activity at hand.[28] If a game contains enough appeal, it better entices players to provide feedback, increasing the likelihood of player involvement and educational potential of the game.

In creating a tactical level wargame that is centralized on the Battle of Dezful, the focus of *Iran-Iraq War* is on tank and maneuver warfare, logistics, and irregular warfare, with additional models of conflict resting on imperfect knowledge and terrain issues. The game

incorporates models of tank warfare that draw on the principles of tank warfare from some of its earliest advocates. One of these advocates was British General J. F. C. Fuller, a veteran of the Second Boer War that ended in the early twentieth century. Fuller is credited for his breakthroughs in mechanized warfare, developing tank strategy that could, and should, have been implemented by both the Iranians and Iraqis. Fuller's ideas inform the design of the game. His strategic objectives list two ways of destroying an organization: "wearing it down" and "rendering it inoperative."[29] Using the logic of aiming straight for the "brain" of an organization, the headquarters, which is usually concentrated behind a series of trenches and obstacles, he felt that only the airplane and tank had the capability to sufficiently cover the distance with the speed needed to surpass these obstacles.[30] Fuller theorized that Napoleonic tactics could be employed on the battlefield with tanks, using movement and surprise to gain the tactical advantage. Frontal amassing of each side would yield no advantage to either side, reserves were the capital for victory.[31]

The ideas of tank theorist Heinz Guderian, a German officer that served as the Third Reich's last army chief of staff, also factor into the game design. The Germans were forced to innovate their war tactics due to their defeat in World War I. In detailing movement, Guderian stated that once contact is made with the enemy, subsequent movement is usually inhibited by hostile fire. In this instance, the enemy must be destroyed, made inoperable or drive from its position, all of which must be done by employing superior firepower. However, Guderian argued that even to gain the upper hand, success for tanks depends on the ability to move quickly, make it difficult for the enemy to build fresh defensive positions, and carry the attack deep into the enemy position.[32]

Finally, Basil Liddell Hart's notion of strategic dislocation represents an important aspect of tank warfare theory. He posits that strategic dislocation is produced when a friendly force's move either: disrupts the enemy's disposition and disorients its organization, separates the enemy forces, endangers supplies, or blocks routes of retreat.[33] Unfortunately, neither the Iranians nor Iraqis subscribed to either of these tactics, but the game is designed so that it can be applied by each player in *Iraq-Iran War.*

Finding inspiration from the Battle of Dezful, the wargame scenario features a heavy focus on tank warfare in effort to force players to make decisions based on the unique situations that are modeled in the real-life conflict. To mimic maneuver warfare on the game board, game mechanics in the decision space, the options of actions that a player can take, are considered.[34] The turn sequence allows the Iranians to go first since they had the offensive. Land movement dynamics are also built into the design, to illustrate how units vary in speed with terrain and other conditions. In the Battle of Dezful, the speed of mechanized warfare presented serious choices for the designers. For example, the designers could give a single unit a move allowance per turn, move allowances could be given a lowest common denominator, or standardized number of moves allowed.[35] The design chosen allowed players to move units based on the speed and capability of each weapon system presented. For example, the Iraqi T-72 tank were contained better range in comparison to the T-62, however the tank is less agile. To account for this, *Iran-Iraq War* gave more T-72 units better range in comparison to the T-62, however the T-62 had better fuel ranges to carry its units farther. Both factors gave each player options in his or her decision space when considering unit employment and maneuver.

Another consideration in maneuver warfare in wargaming is establishing zones of control (ZOC) on the gameboard. A ZOC may fix an enemy or allow friendly forces to be fixed so that

they must be engaged in combat.[36] While fixing and ZOCs were not heavily employed by neither the Iranians nor the Iraqis, it is still a mechanic that will be employed in the scenario, allowing for the theories of Fuller and Guderian to be demonstrated in game play. This is modeled in *Iran-Iraq War* in the range that is determined by each unit. The opposing player must consider if he or she is within the enemy's range and take action accordingly.

Logistics also represents a learning objective for the game. Logistics is vital to warfare yet was disregarded by both the Iranians and Iraqis. The Iran-Iraq War scenario game design forces players to recognize the importance of logistics. During the actual battle, a number of tanks ran out of fuel. Shortly after the operation's conclusion, the Iraqi military had significant artillery issues with Chinese shipments being delayed.[37] The game design represents challenges posed by the supply chain that players must confront in order to succeed.

US Joint Publication 4-0, *Joint Logistics*, states the intended purpose of the supply chain is to understand the requirement, maximize readiness, and optimize allocation of resources. Supply chain management includes the monitoring of forces as they maneuver and expend resources and identify mission-essential systems and equipment, forecasting demands. US joint doctrine states describes the US supply chain as a competitive advantage.[38] Guderian also emphasizes tank logistics as an aspect of firepower, the most important combat characteristic of tanks in his theory of mechanized warfare. He warns that tank forces should be mindful of ammunition expenditure, since the goal is to dominate the enemy's defense in a short period of time with concentrated bombardment. Limiting firepower facilitates artillery preparation.[39]

Because logistics is such a critical factor to warfare and was an issue to both the Iranians and Iraqis, *Iran-Iraq War* is designed to teach players about the considerations of logistical supply chains that are built into the rules of the game. Additionally, players are able to explore

their own supply capability as a competitive advantage over their opponents as detailed in joint doctrine. The intent is to place logistics as part of the wargame's model and force players to question their force's will to expend supplies. Wargame models are used as representations of real judgements experienced, and thus any expenditures will be completed during a turn will have subsequent consequences during gameplay.[40] In Iran-Iraq War, logistical factors will be part of player considerations as players need to understand logistical challenge of the battle. Despite its importance to both the actual battle and the game design, logistics is a model will significantly affect gameplay but will not determine victory.

To facilitate ease of gameplay and lessons to be learned from other aspects of warfighting, complex tables and graphs will not be used to articulate the requirements of logistics. Using logistics computing methods can be advantageous in transparency and ease of use, however they can restrain players and slow down gameplay.[41] Instead a simpler, more visual tracker will stress each player into the decision-making cycle. This mechanic borrows from *Friedrich,* a wargame with a streamlined logistical model. In the game, supply trains are needed to keep forces in supply outside of their own country. If the supply train is more than six spaces away from friendly forces, those forces run the risk of moving out of supply; if they are out of supply for over two turns, they will lose all of their troops.[42] *Iran-Iraq War* provides a logistical area for freedom of movement combined with the tracker and chance cards that offer chances for replenishment.

Iran-Iraq War also incorporates imperfect knowledge as a model of conflict, an underlying dynamic of warfare emulated in the wargame.[43] There were significant intelligence gaps and missteps by the Iranians and Iraqis leading up to the Battle of Dezful. Poor leadership was displayed on both sides, but significantly by the Iranians in before and during the battle.

Iranian President Bani-Sadr was described in Napoleonic terms for his eagerness to engage in this offensive; this was an ironic characterization that foreshadowed Iran's opportunistic offensive but lacked the preparedness and organization of a Napoleon army. Iran's army was ill-prepared, and the timing of the operation was poor. This was the rainy season in the region and the terrain was poor for mechanized warfare.[44] The Iranians, though the aggressor in this scenario, broadcasted their movements to the Iraqis via broadcast communications, though their offensive depended on surprise. Additionally, the Iranians thought that the Iraqi force was departing the area causing them to allocate two additional tank brigades to the battle, but the Iraqis had remained.

While the Iranians had poorly positioned themselves for their assault, the Iraqi brigades had found themselves fifty kilometers inside of Iran without clear objectives against an Iranian force that was starting to organize. The Iraqis had also missed the opportunity to interdict a major network of roads in this area despite gaining the advance. Subsequently, they experienced combat stress after fighting through almost constant attacks by the enemy.[45]

Iran-Iraq War incorporates these conditions through a model of imperfect knowledge. Imperfect knowledge or intelligence gaps can be utilized in a wargame through a command system game with hidden unit knowledge. This means that each player commands units of each side, but information about the units used is hidden from the enemy commander. The game *Friedrich* uses paper with a limit of attack points that can be allocated to each unit, for example. The use of game counters that hide strength numbers or other information can also be used to hide information from enemy forces. *Iran-Iraq War* uses cards to impart imperfect knowledge and intelligence gaps, as well as represent leadership imbalances.

Another model of conflict that was even more significant to the Battle of Dezful was terrain considerations. As previously detailed, the terrain for the time of the year was not sufficient for maneuver warfare, heavy rains confined the heavy armored fighting vehicles to the roads and severely limited traversable surface in the area.[46] In many wargames, the map is a critical piece of development of adequate gameplay. Maps are most often combined with regular grids or hexagons to simulate distance intervals and movement of combat units; this also facilitates ZOCs in gameplay and can be expanded to include terrain features, though it is highly likely that these features will never fit perfectly into the chose grid system. These features can come with movement costs or difficulties to each unit. An excellent example of this is the game *Napoleon*, in which units may move up hill or across streams, but these types of movements will usually slow that unit down. As the following section elaborates, the design of the game attempts to account for and streamline the complexity of the battle, as well as the potential lessons learned from the unique conditions and challenges represented in this historical episode.

***Iran-Iraq War* Game Design**

A wargame can be as abstract or detailed as needed to meet the designers' objectives. The choices designers make to translate objectives into a playable game are apparent in the component design of the game. As Philip Sabin states, "the real art in wargame design is to reflect the almost infinite complexities of warfare within a model that is simple enough to be played but still subtle enough to capture the key dynamics of the actual conflict it seeks to portray."[47] Likewise, the design of an educational game and its components must be intentional, to facilitate learning as a result of game play.

In many military-based wargames, maps are common tools. To adequately depict land warfare in table games, designers often implement some grid-based location system, either square like the Military Grid Reference System (MGRS) or hex-based. Using a square-based grid allows distances to be easily represented, which is key to the realism necessary for a successful educational wargame and are easy to create. While there is an ease of implementation for square-based grids, there are drawbacks. There can be some distortion of natural terrain features, as is a common problem with two-dimensional maps. They can also be limited in possible moves, all movements would have to be completed in 90-degree angles, creating problems with diagonal movement.[48]

As a tactical level wargame with tank maneuver as a main objective, *Iran-Iraq War* uses a 36-inch long and 24-wide map with a hexagon-based grid system. This facilitates the focus of the map on terrain considerations and enforces ZOCs. The hex system used in *Iran-Iraq War* allows more diversity of movement and tighter degrees of angles, while avoiding too much detail in maneuver. The six-sided hexagon gives six straight lines of movement out of a position, offering better maneuver to players. Hexagons still present terrain distortion, but overall offer a better method of detailing unique features.

Finally, the designers must be sure to consider how much area a grid space covers. For this game, each hex represents 2.6 square miles. The map is centered on the marshy area of the Iran and Iraq border, with Susangard presented in the top almost center section of the map (reference Figure 1). No wargame map will wholly and accurately depict the battlefield as it existed. The wargame designers must incorporate the terrain features that are deemed relevant without complicating gameplay.

The terrain features should also be relevant to game objectives. There are two types of terrain features on the game map, linear and non-linear. Linear terrain features affect boundaries rather than zones. An example would be a significant river in the middle of a grid, rendering land force movement through the hex impossible; this force would be forced to move in parallel with the waterway.[49] A non-linear terrain feature are aspects that can affect movement that work in zones.[50] An example would be the marsh zones in *Iran-Iraq War* that hinder movement. While movement is possible, it costs the player speed and maneuverability to do so.

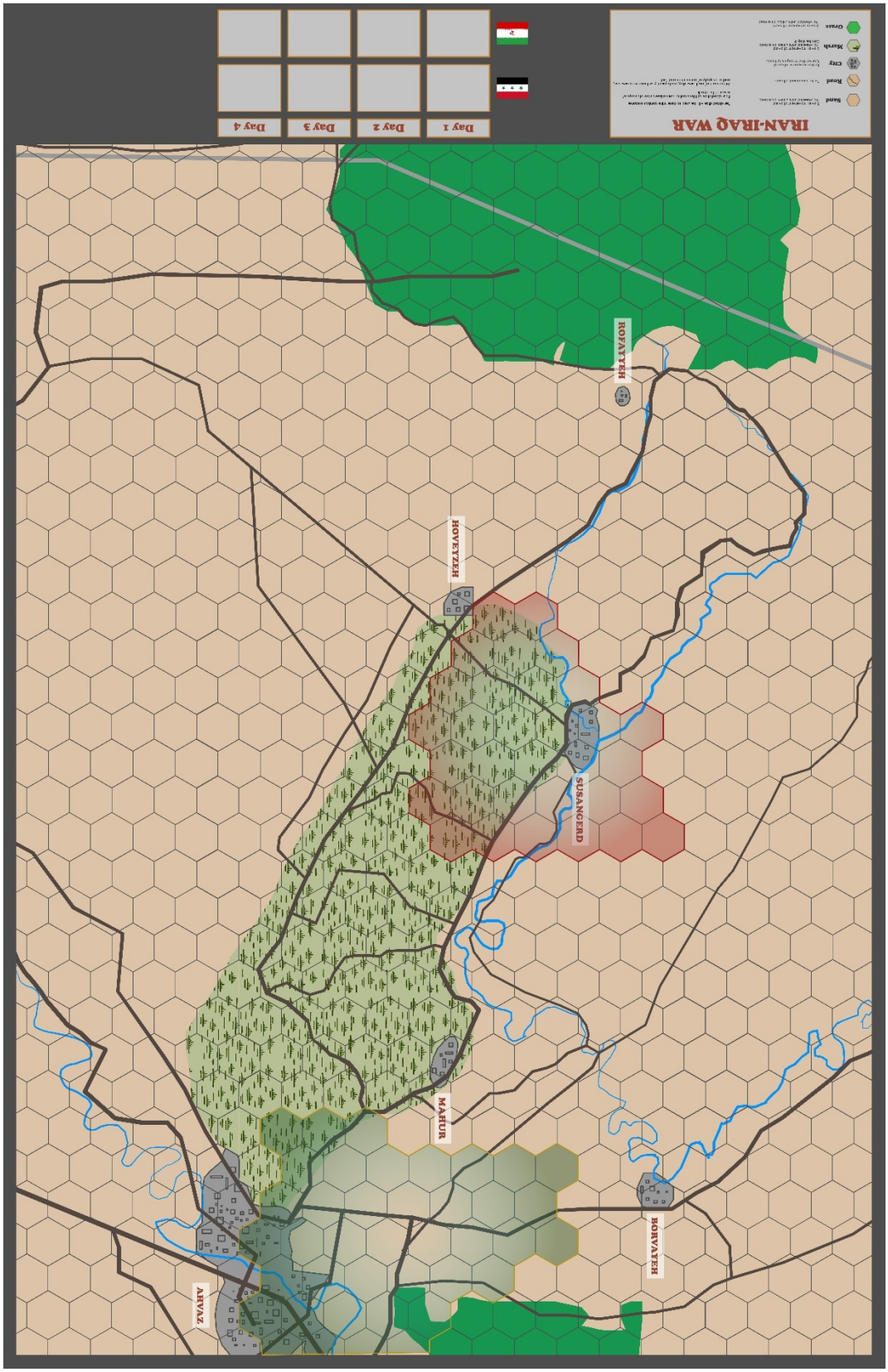

Figure 1 Iran-Iraq War Game Map

The map sets the stage for the *counters*, the game pieces of the game. There are multiple different types of counters, from flat cardboard pieces, plain plastic shapes, Columbia blocks, or small models. Counter design needs to portray the proper amount of information; a counter that contains too much information will slow game play and decrease playability. Balance between aesthetics, utility, and playability is key in designing these components.[51] *Iran-Iraq War* uses numbered meeple that correspond to a unit card containing specific information for that unit (see Figure 2). All cards will display fuel and ammunition capacity for each unit, range, and number of spaces each unit can move both on and off road. These numbers will vary based on the capability of the weapons systems presented.

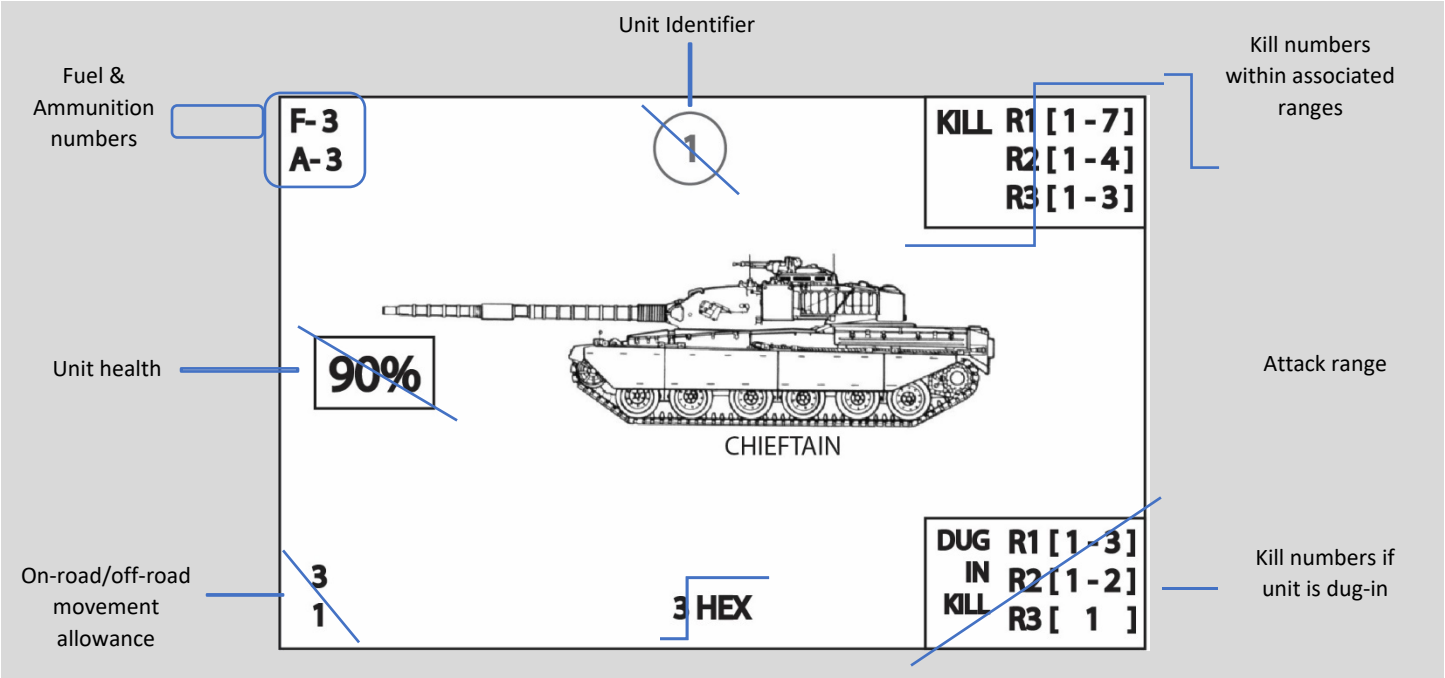

Figure 2 Unit Card

Chance is a vital part of *Iran-Iraq War* and is implemented with dice and a variety of chance cards. Chance is not injected into the game without reason and at random. Rather, it provides unpredictability and stress to game players during gameplay that correspond to actual

conditions during warfare. It gives a less advantaged side some chance of victory and ensures that each game will be a little different. In *Iran-Iraq War*, chance allows the random luck of the Iranians and Iraqis to be represented in combat. A ten-sided dice is used for combat adjudication while one four-sided dice determines battle damage assessed. Each player is provided chance cards detailing a variety of capabilities that can be implemented during turns. These cards can enable air support, additional logistics support, and intelligence and reconnaissance capability.

The final pieces of equipment for use are the game cards used to depict instructions and trackers for unit life, fuel, and ammunition. One goal the game designers had for *Iran-Iraq War* was to promote simple instructions. The designers aimed to balance simplicity of play with an engaging game that facilitated learning. Each player is provided an instruction card with simplified instructions. This design choice was modeled on *Friedrich,* in which a card with pictorial depiction of attack methods encourages ease of gameplay and allows players to engage faster. Boards to track life, fuel, and ammunition are modeled after the logistically focused war game *Race to the Reine*, which small pieces are tracked and taken from each player's card as they are spent. The tracker boards visualize logistic objectives and serves to stress each player as they physically remove resources that are available to him or her.

Actual combat is one of the most difficult experiences to simulate in a wargame, due to its complex combination of physical and psychological variables that are difficult to model or analyze.[52] Wargame designers must determine which key variables of actual combat can be modeled as part of the combat engine without making the game overly complex.[53] Conflict dynamics of *Iran-Iraq War* are less abstract than movement. Victory points are award to each player when an enemy unit is destroyed, the goal of each country becomes not only the objective but also attrition of enemy forces. *Iran-Iraq War* implements a combat engine with a fluid set of

combat adjudication that depends on the unit called to serve and two separate dice rolls for each player. Dice, while still inserting an outcome randomness aspect to gameplay, allow the designers to insert a controlled method of combat adjudication that takes a unit's capabilities or disadvantages into account.

For example, if two units were to attack one, the attacking player's strength would be increased and accounted for on the Combat Result Table (CRT). The CRT is a table predicting probabilities of success or defeat should a unit engage in combat. This is usually based on some ratings of the units, such as attack or defensive ratings. The CRT is convenient in that it provides a quick, graphical reference that can expedite gameplay and allow time for the player's decision space.

There are three types of CRTs: a unilateral table, a ratio table, and a differential table. A unilateral table is one in which each side in turn contain columns that correspond to increasing absolute strength of the attacking team. This table is good in that damage inflicted upon forces parallels force size, however it does not support a combined resolution process. A ratio table is one which depicts the columns reflect increasing ratios of superiority between attacking and defending strengths. This table is good for reflecting the advantages of overwhelming odds, but leave gameplay limited for smaller force sizes. Differential tables use columns to correspond to different attacking and defending strengths. This table does a better job than ratio tables in allowing smaller forces to defend themselves or attack, but overwhelming odds produce the same odds as a lower scale of attack. This renders larger attack numbers potentially useless as larger forces could benefit the defender if the defender maintains an acceptable ratio.[54]

Iran-Iraq War implements an implied differential table to adjudicate combat between forces. Using a differential table based on the unit combined with attack models that consider

the use of overwhelming tank warfare as a force multiplier. This design choice is intended to reflect J.F.C. Fuller's strategy of wearing down an opposing organization by implementing overwhelming force. As an example, a player could choose to allocate several units against one enemy unit if it offers them a tactical advantage or destruction of the enemy unit that would lead to victory points. Allocating multiple units could also force the enemy unit into a ZOC that would force enemy action in an area of the map, however it could come at a cost to other areas that the enemy could gain an advantage.

Three combat mechanics are implemented to ensure that Iraq is not completely defeated in each game, given Iraq's initial disadvantage in the scenario. The first is the use of range effectiveness of attack for each unit that differ if the unit is dug-in to its position or not. Digging in was a technique used during the Battle of Dezful, as the marshes were nearly impassable by tank, they dug into the mud. While the tanks could not move from their position, they maintained a low profile and were able to still fire from their positions. Digging in had its advantages, however it effectively rendered the tank immobile for some time. Using this option in the game, takes away movement points from the player using it, but significantly increases their defense.

The second mechanic is the use of dice to adjudicate combat. This allows more chance for a variety of outcomes on the CRT. Looking at Figure 2 as an example, this unit of Iranian Chieftains is at ninety percent of its possible health at the beginning of the game. It has the ability to move on road at three hexes or off-road at one hex per turn and fuel piece. The unit's attack effectiveness varies at different ranges. This unit also has the ability to dig-in to its terrain based on the availability of the information at the bottom right portion of the card. This unit can also attack within 3 hexes of itself. The ten-sided dice for this game has a number range of zero

through eight. This unit has the highest probability of landing a hit on an attack when it is within one hex of its enemy with a probability of eighty percent of achieving a hit. That number goes down to fifty percent at two hexes, and forty percent at three. At a dug-in position, probabilities again suffer, with forty percent at a range of one hex, thirty percent at a range of two hexes, and twenty percent at a range of three hexes. These probabilities differ between units and were created to factor in human error and lack of training, both characteristics of the Iranian and Iraqi forces.

Examining the probabilities of a successful attack lends credibility to the application of operations analysis to wargaming decision-making, and thus some insight into education wargame design. Table 1 takes the attack probabilities of a hit, signified by a *U*, against the range of hexes that an attack is made, a range of one hex is designated with *R1*, a range of two hexes is designated *R2*, and a range of three hexes is designated with *R3*.

	R1	**R2**	**R3**
U1	.8	.5	.4
U2	.6	.5	.4
U3	.8	.6	.4

Table 1 Payoff Matrix

Table 1 is a payoff matrix which represents courses of action, in this instance attack, that can be considered by the players when weighing the decision of which units would be most advantageous in an attack.[55]

	R1	R2	R3	Guaranteed payoff
U1	.8	.5	.4	.4
U2	.6	.5	.4	.4
U3	.8	.6	.4	.4

Table 2 Guaranteed Payoff

Table 2 considers guaranteed payoffs, which factors the worst possible outcome for an attacker, which happens to be at a range of three hexes regardless of unit.[56] No particular unit stands out in this group.

	R1	R2	R3	Maximum Regret
U1	0	.1	0	.1
U2	.2	.1	0	.2
U3	0	0	0	0

Table 3 Regret Matrix

Finally, a regret matrix, shown in Table 3, allows a player to compute the amount of regret he or she may have by proceeding to attack a unit.[57] According to this table, unit two presents the most potential for regret if it is used. This regret translates to the amount of risk that this player may experience during gameplay should he or she chose to use this unit in an attack. In only factoring regret, the player may choose to use unit three has his or her aggressor, or unit most used to confront the enemy. All of these tables do not factor the maximum benefit of achieving forty percent damage to an enemy unit. Players do not see the payoff and regret matrices and this detail is not included in the game instructions; however, these are statistics that can be

factored in to game design to ensure that unit variances are applied (reference the T-72 and T-62 example) and that gameplay meets the intent of the specified learning objectives.

The third mechanic is the use of chance cards. Each player will begin the game with three cards: "Air Superiority" grants an increase in attack effectiveness based on the roll of a four-sided dice; "Reconnaissance" grants an additional move of two spaces; and "Artillery" also grants an increase in attack effectiveness based on the roll of a four-sided dice. A separate pile of chance cards will be available at the beginning of each day. These cards include: "Western Support" which allows for fifty percent replenishment of resources to one unit on the board; "Bad Leadership" in which the other team loses a turn; and "Surprise" which allows a unit to move anywhere within five spaces of its current location without fuel expenditure. All of these cards represent resources that were available to Iran and Iraq during the war. These are resources are made available by chance to reflect the incompetent ability to employ these advantages by each country, to illustrate the impact of these factors on the course of the battle, and to avoid a predetermined outcome for the game.

While not an objective of the game, the entire process of creating and playing an educational wargame posits the practicality of game theory into game design. According to Narahari, "game theory is a tool for logical and mathematical analysis that models conflict as well as cooperation between the decision makers and provides a principled way of predicting the result of the interactions among the players using equilibrium analysis."[58] The three choices of movement, attack, or dig-in that each player can take per unit upon his or her turn provides an opportunity to use game theory, the analysis of design, to help establish the futility of *Iran-Iraq War's* game design in regards to its educational purpose.[59] Game theory could be he piece that completes the translation of wargaming into an educational tool. It uses abstractions,

mathematical probability, and matrices to attempt to explain and model human decision making. Furthermore, games are represented as strategic form games or normal form games, which attempt to create a payoff matrix in which a player can determine the course of action most advantageous to achieve the outcome that they wish to achieve. This can be achieved with or without mathematical formulas. As detailed previously, statistical models of decision making based on the models incorporated in gameplay translate roughly to operational analysis that factor in to real-world decision making. For example, while *Iran-Iraq War* does not overtly use combat adjudication tables, the mathematical probability of dice rolls combined with the chance cards and numerical data contained on each unit card are all based on abstractions presented by the real-world scenario of the Battle of Dezful. The amount of risk and reward must be considered by each player as he or she makes a decision based on three choices, which expand to a set of probabilities based on enemy advantages or disadvantages, dice probabilities, and chance based on those dice rolls or card play. Essentially, a player's decision space is dominated by latent game theory.

Conclusions

Developing any wargame is a significant challenge, and often reflects a marriage of multiple elements of a design process necessary to reach the desired educational results. Some of this is commensurate with the level of abstraction desired by the game designers. Game design is a combination of art and science, blending military theory with the principles of wargaming, and probabilities. *Iran-Iraq War* is no different. Ideally, the design of the game translates the intent to achieve desired learning objectives into a play-able game that delivers measurable learning outcomes. Iran-Iraq War combines different elements of warfare into a

game based on a historical episode, without burdening the gameplay with unwieldy rules and contextual information. It reflects a balance competing challenges that must be considered by the player. While it is historically grounded, it also incorporates an element of chance, expands the decision-space for the players and further enables the intentional lessons of the game. The game is somewhat abstract, but there is some information to be inferred from the probability and chance inserted into the CRT and with the chance cards. The game hopes to successfully show the younger military population the importance of deliberate movement, logistics, and planning for chance.

---

[1] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 157.
[2] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 157.
[3] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 158.
[4] Per-Idar Evensen et al., "Wargaming Evolved: Methodology and Best Practices for Simulation-Supported Wargaming," *Interservice/Industry Training, Simulation, and Education Conference* (2019), https://fhs.brage.unit.no/fhs-xmlui/bitstream/handle/11250/2652599/1761821.pdf?sequence=1&isAllowed=y, 4
[5] Sebastian Bae, "Introduction to Wargaming," (lecture, Marine Corps University, Quantico, VA, October 2, 2020).
[6] Sebastian Bae, "Introduction to Wargaming," (lecture, Marine Corps University, Quantico, VA, October 2, 2020).
[7] Mark Herman, Mark Frost, and Robert Kurz, *Wargaming for Leaders* (New York, NY: McGraw Hill, 2009), 12.
[8] Philip Sabin, *Simulating War* (London: Bloomsbury Academic, 2012), 19.
[9] Philip Sabin, *Simulating War* (London: Bloomsbury Academic, 2012), 3.
[10] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 159.
[11] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 158.
[12] Sebastian Bae, "Introduction to Wargaming," (lecture, Marine Corps University, Quantico, VA, October 2, 2020).
[13] Sebastian Bae, "Introduction to Wargaming," (lecture, Marine Corps University, Quantico, VA, October 2, 2020).
[14] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 158.
[15] Sebastian Bae, "Defining Wargame Mechanics and Adjudication," (lecture, Marine Corps University, Quantico, VA, December 1, 2020).
[16] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 159.
[17] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 159.
[18] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 159.
[19] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 159.
[20] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 159.
[21] Efraim Karsh, *The Iran—Iraq War 1980* – 1988 (Oxford: Osprey Publishing, 2002), 31.

[22] Sebastian Bae, "Defining the Game System and Adjudication," (lecture, Marine Corps University, Quantico, VA, November 6, 2020).
[23] Roger Mason PhD, "Commercial Wargames and Experiential Learning," LECMgt last updated February 12, 2021, lecmgt.com/blog/commercial-wargames-and-experiential-learning.
[24] Roger Mason PhD, "Commercial Wargames and Experiential Learning," LECMgt last updated February 12, 2021, lecmgt.com/blog/commercial-wargames-and-experiential-learning.
[25] Roger Mason PhD, "Commercial Wargames and Experiential Learning," LECMgt last updated February 12, 2021, lecmgt.com/blog/commercial-wargames-and-experiential-learning.
[26] Roger Mason PhD, "Commercial Wargames and Experiential Learning," LECMgt last updated February 12, 2021, lecmgt.com/blog/commercial-wargames-and-experiential-learning.
[27] Saul McLeod, "Kolb's Learning Styles and Experiential Learning Cycle," Simply Psychology last updated 2017, https://www.simplypsychology.org/learning-kolb.html.
[28] Sebastian Bae, "Wargaming as an Educational Tool," (lecture, Marine Corps University, Quantico, VA, October 21, 2020).
[29] J.F.C. Fuller, "Tank Warfare," in *The Art of War in World* History, ed. Gérard Chaliand (Berkeley: University of California Press, 1994), 923.
[30] J.F.C. Fuller, "Tank Warfare," in *The Art of War in World* History, ed. Gérard Chaliand (Berkeley: University of California Press, 1994), 924
[31] J.F.C. Fuller, "Tank Warfare," in *The Art of War in World* History, ed. Gérard Chaliand (Berkeley: University of California Press, 1994), 925.
[32] Heinz Guderian, "Tank Attack," in *The Art of War in World* History, ed. Gérard Chaliand (Berkeley: University of California Press, 1994), 951.
[33] Basil Liddell Hart, "The Strategy of Indirect Approach," in *The Art of War in World* History, ed. Gérard Chaliand (Berkeley: University of California Press, 1994), 928-929.
[34] Sebastian Bae, "Defining the Game System and Adjudication," (lecture, Marine Corps University, Quantico, VA, November 6, 2020).
[35] Philip Sabin, *Simulating War* (London: Bloomsbury Academic, 2012), 85.
[36] Philip Sabin, *Simulating War* (London: Bloomsbury Academic, 2012), 86.
[37] Williamson Murray and Kevin M. Woods, *The Iran—Iraq War* (Cambridge: Cambridge University Press, 2014), 156.
[38] Joint Chiefs of Staff, *Joint Publication 4-0 Joint Logistics* (Washington, DC: Joint Chiefs of Staff, 2019), II-3, https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp4_0ch1.pdf?ver=2019-05-10-120259-860.
[39] Heinz Guderian, "Tank Attack," in *The Art of War in World* History, ed. Gérard Chaliand (Berkeley: University of California Press, 1994), 955.
[40] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 197.
[41] Peter Perla, *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*, ed. John Curry (Middletown: United States Naval Institute, 2011), 198.
[42] Richard Sivél, *Friedrich Rules Booklet* (Berlin: Histogame, 2011), 5-6.
[43] Sebastian Bae, "Creating Game Components," (lecture, Marine Corps University, Quantico, VA, December 14, 2020).
[44] Williamson Murray and Kevin M. Woods, *The Iran—Iraq War* (Cambridge: Cambridge University Press, 2014), 144.
[45] Williamson Murray and Kevin M. Woods, *The Iran—Iraq War* (Cambridge: Cambridge University Press, 2014), 148.
[46] Williamson Murray and Kevin M. Woods, *The Iran—Iraq War* (Cambridge: Cambridge University Press, 2014), 145.
[47] Philip Sabin, *Simulating War* (London: Bloomsbury Academic, 2012), 68.
[48] Philip Sabin, *Simulating War* (London: Bloomsbury Academic, 2012), 71.
[49] Philip Sabin, *Simulating War* (London: Bloomsbury Academic, 2012), 74.
[50] Philip Sabin, *Simulating War* (London: Bloomsbury Academic, 2012), 75.
[51] Sebastian Bae, "Introduction to Wargaming," (lecture, Marine Corps University, Quantico, VA, October 2, 2020).
[52] Philip Sabin, *Simulating War* (London: Bloomsbury Academic, 2012), 87.
[53] Philip Sabin, *Simulating War* (London: Bloomsbury Academic, 2012), 87.
[54] Philip Sabin, *Simulating War* (London: Bloomsbury Academic, 2012), 93-94.

[55] United States Naval Academy, *Naval Operations Analysis,* 2nd ed. (Annapolis: Naval Institute Press, 1977), 24.
[56] United States Naval Academy, *Naval Operations Analysis,* 2nd ed. (Annapolis: Naval Institute Press, 1977), 26.
[57] United States Naval Academy, *Naval Operations Analysis,* 2nd ed. (Annapolis: Naval Institute Press, 1977), 26.
[58] Y Narahari, *Game Theory and Mechanism Design* (Hackensack, New Jersey: World Scientific/Indian Institute of Science, 2014), eBook, 1-2.
[59] Y Narahari, *Game Theory and Mechanism Design* (Hackensack, New Jersey: World Scientific/Indian Institute of Science, 2014), eBook, 1.

Bibliography

Bae, Sebastian. "Introduction to Wargaming." Lecture. Marine Corps University, Quantico Marine Corps Base, VA, October 2, 2020.

Bae, Sebastian. "Wargaming as an Educational Tool." Lecture. Marine Corps University, Quantico Marine Corps Base, VA, October 21, 2020.

Bae, Sebastian. "Defining Wargame Mechanics and Adjudication." Lecture. Marine Corps University, Quantico Marine Corps Base, VA, December 1, 2020.

Bae, Sebastian. "Creating Game Components." Lecture. Marine Corps University, Quantico Marine Corps Base, VA, December 14, 2020.

Fuller, J.F.C. "Tank Warfare." In *The Art of War in World History,* edited by Gérard Chailand, 921-926. Berkeley: University of California Press, 1994.

Guderian, Heinz. "Tank Attack." In *The Art of War in World History,* edited by Gérard Chailand, 949-956. Berkeley: University of California Press, 1994.

Hart, Basil Liddell. "The Strategy of Indirect Approach." In *The Art of War in World History,* edited by Gérard Chailand, 927-931. Berkeley: University of California Press, 1994.

Herman, Mark, Mark Frost, and Robert Kurz. *Wargaming for Leaders.* New York, NY:

McGraw Hill, 2009.

Joint Chiefs of Staff. *Joint Publication 4-0 Joint Logistics.* Washington, DC: Joint Chiefs of Staff, 2019. https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp4_0ch1.pdf?ver=2019-05-10-120259-860

Karsh, Effraim. *The Iran—Iraq War, 1980-1988.* Oxford: Osprey Publishing, 2002.

Murray, Williamson and Kevin M. Woods. *The Iran—Iraq War.* Cambridge: Cambridge University Press, 2014.

Narahari, Y. *Game Theory and Mechanism Design.* Hackensack, NJ: World Scientific/Indian Institute of Science, 2014.

Perla, Peter. *Peter Perla's The Art of Wargaming a Guide for Professionals and Hobbyists*. Edited by John Curry. Middletown: United States Naval Institute, 2011.

Sabin, Philip. *Simulating War.* London: Bloomsbury Academic, 2012.

Sièvel, Richard. *Friedrich Rules Booklet.* Berlin: Histogame, 2011.

United States Naval Academy. *Naval Operations Analysis.* 2nd Ed. Annapolis: Naval Institute Press, 1977.