CONCEPTS, IDEAS, AND FRAMEWORKS EMERGING FROM OPERATIONAL-TACTICAL WARGAMES

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Abstract. The article describes the operational-tactical phenomena that were observed and analyzed in different wargames. Research was conducted in a qualitative paradigm, using observation as a data collection method and inductive coding as the main data analysis tool. Thereafter, the findings are connected to the existing operational-tactical concepts and, finally, key aspects of wargame design and emerging concepts for warfare are described. The findings are divided into four categories using operational factors as a framework: time, space, force, and information. First, the study provides evidence in category information, i.e., understanding the end-state (victory condition) is vital for success. Second, the research indicates that operational objectives, operational key terrains, and tactical key terrains are interlinked, and their nature and value should be assessed through such connection. In addition, the study emphasizes how the lines of communication and the enemy's effects on them affect operational reach. The research also revealed the significant effect of the area of influence (AOI) on the enemy's speed and formation because of the threat generated in the area of influence that is occupied by a friendly force. Findings in the category 'forces' highlight the interdependence between joint functions, intelligence and fires, and explain the effects of electronic warfare and cyber-attacks on operational mobility through the disruption of command and control. In the category of 'time', the study emphasizes how the relative nature of time (tempo) can affect both sides and how the season can affect the forces. Thereafter, the article continues with a description of important concepts regarding wargame design: first, victory conditions as a combination of operational factors (emphasizing the element of information) and, second, sequencing the game on an operational level by using different combat functions. Finally, there is a description of the validity and utility of a multi-sensor shooter network, highlighting the possibility of employing wargames in training and force development for multinational joint operations in the Baltic States.

Keywords: wargame, operational factors (time, space, force, and information), key terrain, lines of communication, area of influence, intelligence-fires synergy, operational end state (victory condition in wargames paradigm), wargame sequencing, modification of unit characteristics

1. Introduction

Wargames can be used as a tool for military education, training and analysis. Since the results of wargames depend on human decisions, such games are a suitable way for discovering dynamics in poorly framed problem sets like operational or tactical warfare. The article describes operational-tactical phenomena discovered in 12 wargames, observed during the authors' studies in the US Army Command and General Staff College in Fort Leavenworth 2021–2022. All the games did not address the same scenario, therefore a wide approach to research design was used. The study aims to identify general tactical and operational concepts, ideas, problems, and opportunities that emerge from wargames. Because of such a focus, the study will not concentrate on a detailed explanation of scenarios or detailed descriptions of participant decisions. Within that framework, three research questions were established. First, which operational-tactical level concepts, ideas and problems can be discovered from wargames? Second, based on the findings of the first question, what are the implications for modern operational-tactical wargames? Third, how can the answers to the first two questions be used to benefit the concepts of operational-tactical warfare in the Baltic region?

2. Methodology

According to Perla and Branting, wargames most likely provide unquantifiable data[1], therefore this research was conducted using qualitative analysis. For data collection, the author conducted a multi-event, holistic, participatory observation[2] of different events (wargames) in the US Army Command and General Staff College Simulation Department where the author participated as a player. The risk of author bias was assessed and it was found to be low due to the fact that the events were not graded or otherwise evaluated. Wargames under observation took place from August 2021 to May 2022, including 8 operational and 4 tactical (division and corps) level games. An example of the observation diary is presented in table no 1.

[1] **Perla, P. P.; Branting, D. L**. 1986. Wargames, Exercises and Analysis. Virginia, US: Hudson Institute, Center for Naval Analyses, p. 7.

[2] **Patton, M. Q**. 2015. Qualitative Research & Evaluation Methods. Fourth edition. Sage Publications, pp. 239, 356–357. [**Patton** 2015]

Table 1. Sample of observation note

Date	Game name	Observation number	Observation	Operational factors	Main connections to the existing concepts
12.10. 2021	Race to the Rhine	17	Faster tempo forced the enemy to re-plan but if we extend LOC too much without fixing or destroying the enemy forces, it can generate threats. The prioritization of LOC in accordance with a campaign plan to achieve the objective is vital. Key element tends to be balance between combat service support and combat units. Air resupply could be a solution to extent, but AD threat hampers it. The amritime resupply can provide unique opportunities, but the port opening / enemy effects might hamper it.	Operational factor – time (tempo) and forces	Operational reach, logistics (joint function), sustainment (combat function), lines of communications, objective, basing,

To answer the first research question, the data was coded with an inductive analysis[3] employing elements of cross-case analysis[4] to determine the themes and patterns discovered through multiple wargames. The codes were categorized into code groups which were organized between operational factors (based on the Vego framework) using time, space, force, and information[5]. Thereafter, the findings were described using the previously explained operational factors. To answer the second and third research questions, elements of deductive analysis[6] were used: findings were connected to the existing operational or historical concepts to generate a wider framework and examples for the discovered phenomena. Finally, based on the findings, the study provides four characteristics for operational level analytical wargame development and establishes three concepts for operational-tactical level warfare in Estonia and the Baltic States.

[3] **Patton** 2015, p. 541.

[4] Ibid., p. 551.

[5] **Vego, M**. 2007. Joint Operational Warfare. Theory and Practice. Newport: U.S. Naval War College. 2008 Edition, pp. III-3, III-51. [**Vego** 2007]

[6] **Patton** 2015, p. 551.

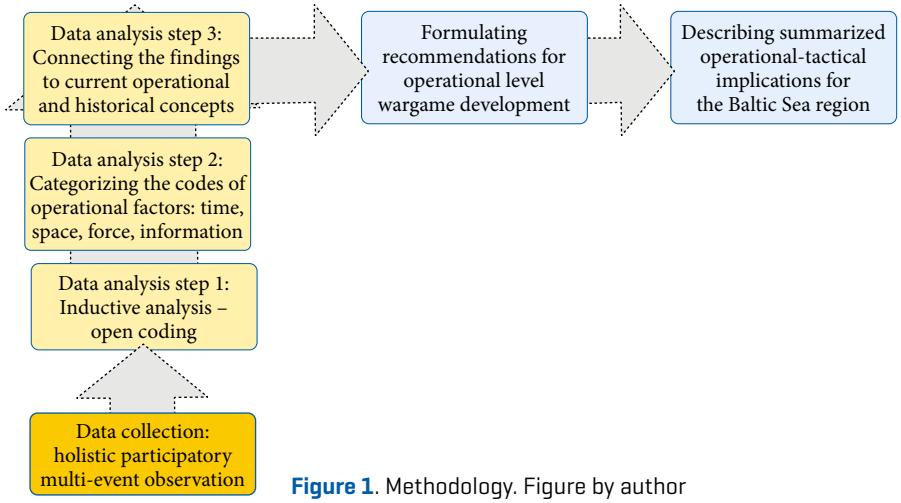

Figure 1. Methodology. Figure by author

3. Results

This section provides an answer to the first research question by grouping findings into four categories based on operational factors. The findings are displayed and summarized in figure 2.

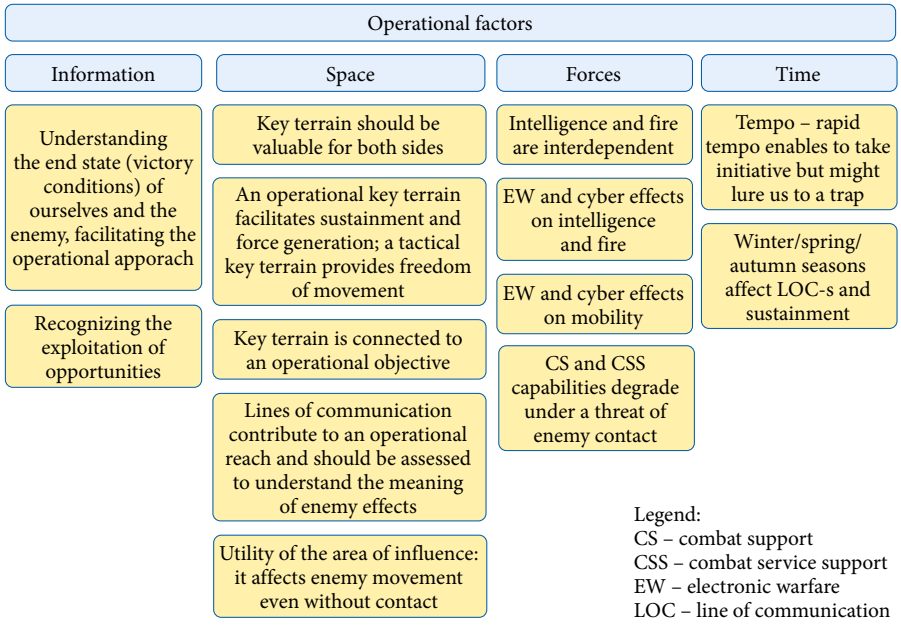

Figure 2. Key findings grouped by the operational factors. Figure by author

3.1. Overarching concept – operational end state and findings in the information category

The first finding overarches across all operational factors—the importance of determining the end state of an operation which, in the wargaming paradigm, is also referred to as a victory condition. Answering the question "what does victory look like" enables commanders to generate a pathway (operational approach) to the desired end state. Based on observations, the determination of the end state (victory condition), or selecting a combination of victory conditions from multiple ones, enabled participants to establish a cohesive course of action and pursue it in an aggressive manner[7]. This observation fits with the current NATO operational planning directive (AJP-5) which defines 'end state' as conditions that define an acceptable conclusion to a situation. The AJP-5 also states that an end state must be determined before military forces are committed[8]. These elements support the findings from the study by emphasizing the need for determining the end state (victory conditions) before executing operations. However, the theoretical framework of the end state provides some evidence that a certain amount of flexibility is required to reassess certain conditions. In his research, Lafave describes how the military end state should be planned, keeping flexibility in mind, while addressing possible transitions to non-military agencies[9].

The other perspective of the end state is connected to the operational factor of information. Several findings demonstrated the value and positive effect of assessing the enemy's end state / victory condition[10]. If the participants built an enemy course of action without first understanding the enemy end state, then it resulted in more friction[11]. The other element in the category of information was the need to find opportunities to exploit. Understanding enemy failures—like piecemeal commitment[12]—provided opportunities to

[7] **Wargames observation notes** 2022. Authors' private collection, entry no 8 and 10. [**Wargames notes** 2022]

[8] **AJP 5**. 2019. Allied Joint Doctrine for the Planning of Operation. Edition A, Version 2. NATO Standardization Office, p. 3–4.

[9] **Lafave, B. D**. 2019. Re-Understanding End States. Monograph. Fort Leavenworth, KS: School of Advanced Military Studies, US Army Command and General Staff College, pp. 37–39.

[10] **Wargame notes** 2022, entry no 10.

[11] **Wargame notes** 2022, entry no 8.

[12] **ADP 3-90**. 2019. Offense and Defense. Washington, D.C.: Headquarters, Department of the Army, p. 2–15.

the participants to mass effects and exploit success on the battlefield[13]. However, such exploitation requires an uncommitted force, otherwise it does not materialize or would require too much time, leading to changing conditions. One example is the Russian campaign in Ukraine in March 2022 where Russian commanders committed their forces piecemeal (in battalion or regimental size groups) but were, according to the ISW, not able to synchronize operations towards common objectives[14]. Such conditions can facilitate different options to launch counter-offensives if operational reserves are available, but this was not the case in March 2022.

3.2. The operational factor of space

To describe the findings in the category of space, Vego's framework is used; this provides a twofold description. First, it represents the mean environment where fighting takes place. Second, space is often an objective of a fight: a geographical location that must be controlled to achieve success[15]. The first finding in this category is the value of a key terrain and its different nature on tactical and operational levels. 'Key terrain' is defined in ATP-3.2.1 as a terrain that gives an advantage to the side who controls it[16]. While the NATO operational level planning documents do not define key terrain as an operational design element, these still explain the validity of operational factor space (i.e., AJP 5)[17] and there are references to the key terrain concept in the US joint planning process[18]. Within the framework of this article, the terms 'tactical key terrain' and 'operational key terrain' are used to highlight their unique nature at different levels of war. Simultaneously, the term 'operational key terrain' links to the elements of an operational design objective and decisive point. According to doctrinal publications, a key terrain can

[13] **Wargame notes** 2022, entry no 19.

[14] **Institute for the Study of War** 2022. Russian Offensive Campaign Assessment, March 3. https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-march-3 (25.07.2022).

[15] **Vego** 2007, p. III-7.

[16] **ATP-3.2.1**. 2009. Allied Land Tactics. NATO Standardization Agency, p. 6–4.

[17] **AJP-5**. 2019. Allied Joint Doctrine for the Planning of Operation. Edition A, Version 2, Annex A. NATO Standardization Office.

[18] **JP 3-0**. 2018. Joint Operations. Washington, D.C., pp. II-11 and V-18.

be either a decisive point[19] or the objective[20], but both elements can also focus on other operational factors like enemy units or functions.

3.3. Operational and tactical key terrains and their connections

Several elements of this research indicate that tactical level key terrains were mainly defined as locations that enable freedom of movement—like junctions, bridges, crossing sites and other locations where mobility corridors are linked to each other[21]. One significant factor was that several tactical key terrains were located inside urban areas or in their proximity, which we can also see in the modern conflict in Ukraine, as referred to in the analysis conducted in the Institute for the Study of War (ISW)[22]. The value of a tactical key terrain in wargames was highlighted through the fact that a key terrain had to provide a significant advantage for both sides. The following dynamics were discovered: the blue side assessed a key terrain as locations A and B; the red side assessed it as locations B and C, specifying that the actual key terrain according to the definition was location B.[23] Continuous assessment of tactical key terrains and their value in wargames facilitated success, i.e., the achievement of victory conditions / end state. Such dynamics can also be discovered in the Korean War battles in the vicinity of the Chosin reservoir where the villages/junctions of Hagaru-ri and Koťo-ri provided freedom of movement for both sides, thereby serving as tactical key terrains[24].

Operational level key terrains were mainly connected to sustainment, force projection, and politically and morally important cities. Those included, for example, airfields, ports, railway junctions, major river crossing sites, cities and industrial hubs with advanced road networks which could facilitate the sustainment of operations. The significance of operational key terrains presented itself in two areas. First, force generation and sustainment. Key terrains

[19] **JP 5-0**. 2020. Joint Publication 5-0. Joint Planning. Washington, D.C., p. IV-32.

[20] **AJP-5**. 2019. Allied Joint Doctrine for the Planning of Operation. Edition A, Version 2, Annex A. NATO Standardization Office, Lex-11.

[21] **Wargame notes** 2022, entry no 2.

[22] **Institute for the Study of War**. 2022. Russian Offensive Campaign Assessment, April 1. https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-april-1 (12.07.2022).

[23] **Wargames observation notes** 2022, entry no 2.

[24] **Combat Studies Institute** 1983. Chosin Reservoir. CSI Battlebook. Fort Leavenworth, KA, pp. 34, 38, 70.

like airfields and ports facilitated the force flow into the theater, and control of those key terrains gave a significant advantage[25]. The second area was connected to the strategic level: control over major cities means control over a large portion of the population and affects the moral status of the nation[26]. In the operational-strategic framework, we find one example in operation Iraqi Freedom where the operational key terrains in the initial conventional operation phases were connected to sustainment. For example, the Karbala Gap was significant to both sides because of the high-speed avenue of approach it provided towards Baghdad. Simultaneously, it was important because of its utility for sustaining operations, which enabled the decisive operation towards Baghdad[27].

The connection between tactical and operational key terrains is illustrated in Figure 2. Sometimes tactical and operational key terrains overlap, like a major bridge that simultaneously enables tactical movement and operational sustainment. The other dynamics discovered were the chain-like connection between tactical key terrains, operational key terrains, and operational objectives. Tactical key terrains enabled a generation of effects to achieve control over operational level key terrains, which then helped to achieve operational objectives. One example of a connection between operational-tactical key terrains and operational objectives is General Lee's Maryland campaign in 1862 when Union cities (like Washington D.C and Baltimore) represented an operational key terrain from which General Lee planned to dislocate the Union forces[28]. Simultaneously, the crossing sites on the river Potomac—like Harper's Ferry or Shepherdstown—were tactical key terrains (generated freedom of movement by enabling access to operational key terrains) and operational key terrains (generated operational sustainment and facilitated operational maneuvers)[29].

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[25] **Wargames observation notes** 2022, entry no 3.

[26] **Wargames observation notes** 2022, entry no 1, 3, 18.

[27] **Degen, E. J; Fontenor, G; Tohn, D**. 2004. On Point. US Army in Operation Iraqi Freedom. Office of the Chief of Staff US Army, Washington D.C. Fort Leavenworth, KA: Combat Studies Institute Press, p. 238.

[28] **Hartwig, S**. The Maryland Campaign of 1862. https://www.battlefields.org/learn/articles/maryland-campaign-1862 (15.09.2022).

[29] **Jamieson, D. P.; Wineman, B. A**. 2015. Maryland and Fredericksburg Campaigns 1862–1863. Center of Military History United States Army Washington, D.C., pp. 10, 18.

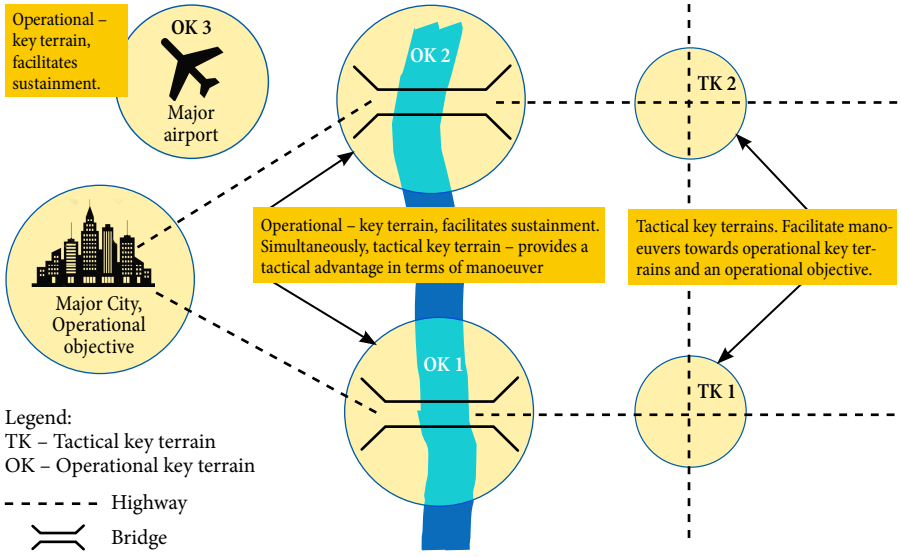


Figure 3. Dynamics between a tactical key terrain, an operational key terrain and an operational objective. Figure by author

3.4. Significance of the lines of communication

The next element described in the category of space is the meaning of lines of communication (LOC). According to MILITERM, lines of communication are any route that enables forces to access supply bases[30]. Newell describes transportation via lines of communication as one of the primary factors affecting the sustainment of operations[31]. Transportation and movement is one of the functional areas of logistics and is in direct correlation with the amount and quality of LOC[32]. Regarding lines of communication, it is important to emphasize their operational significance in three areas as determined in research (also illustrated in Figure 3). First, LOC contribute to operational reach. LOC facilitate the generation of combat power and sustainment, but also freedom of maneuver by enabling the repositioning of force elements into different locations. The other area which was found to be significant was

[30] **MILITERM** 2022. https://sonaveeb.ee/search/unif/dlall/mil/lines%20of%20communications/1 (28.09.2022).

[31] **Newell, R. C**. 1991. The Framework of Operational Warfare. London & New York: Routledge, pp. 105–110.

[32] **AJP-4**. 2018. Allied Joint Doctrine for Logistics. Edition B, Version 1. NATO Standardization Office, p. 5–3.

the effect of losing a line of communication. Since all LOC do not have the same importance to an operation, it was found vital to study and understand the effect of enemy actions against LOC. Such understanding facilitates risk assessment and prioritization of LOC and the assets designated to protect them. It also enables assessment of the condition and value of enemy LOC and enables assets to be dedicated to disrupt or deny them.

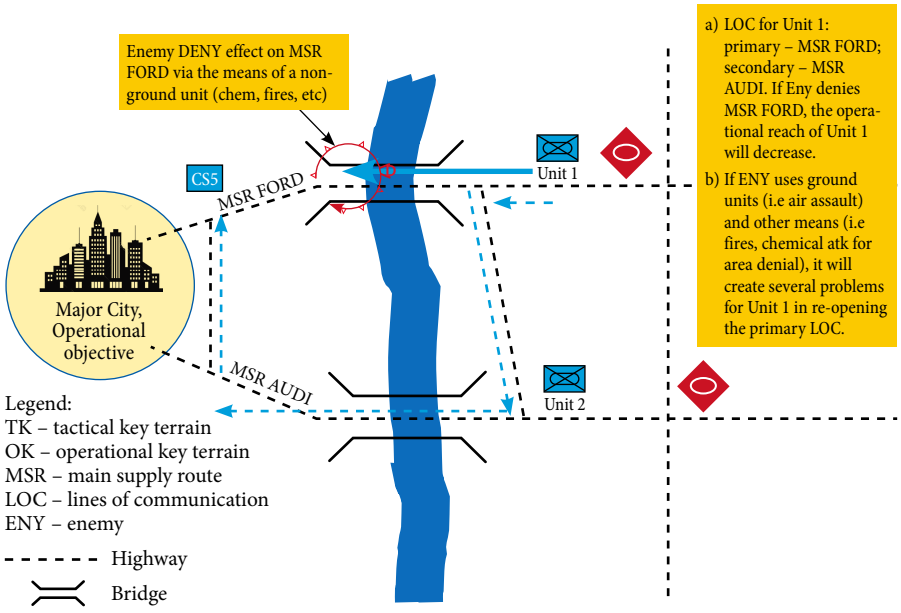


Figure 4. Dynamics between a tactical key terrain, an operational key terrain and an operational objective. Figure by author

The other aspect discovered in research was the nature of effects against LOC. There are several examples in history about denying LOC by moving a force element on it, like when Russian forces penetrated the vicinity of Ruhja during the Estonian War of Independence, threatening the GLOC (railway) of the Estonian forces and therefore requiring immediate counterattack to neutralize the threat[33]. The current study provided evidence of a continued relevance of such a maneuver, but there are also new ways and means. Several incidents in wargames indicated that modern methods of attack are able to disrupt LOC: cyber-attacks, information operations, operational fires, and chemical attacks

[33] **Eesti Vabadussõja Komitee** 1939/1996. Eesti Vabadussõda 1918–1920, I. Kordustrükk. Tallinn: Mats, pp. 539–544.

are all used to achieve area denial[34]. It was also discovered that one effective method to disrupt or deny operational LOC was a dual attack, i.e., conducting a maneuver with a physical force element to cut off the operational-tactical LOC (direct approach), simultaneously generating disruptive effects in an operational-strategic depth using air assets, operational fires and cyber operations (indirect approach).

Based on the ISW summary, one example of such a dynamic can be found in the Ukrainian forces' operations on the Herson axis in late August 2022[35]. Herson city itself was an operational-strategical objective due to its political-social value. Simultaneously, the land lines of communication across the Dnepr River—and, to a lesser extent, also across the Bug River—provided examples of the significance of LOC. First, these lines were operationally significant because they enabled the Russian forces to sustain operations to the west of Herson. Second, these land lines had tactical value because of the mobility they provided. There is also a connection identified between the operational objective (Herson) and the land lines supporting its defense: the lines of communication across the previously-mentioned rivers generated sustainment and movement opportunities for forces designated to defend the operational objective. The Ukrainian forces' use of operational fires in the deep area to attack those land lines—mainly crossing sites—severely disrupted the Russian defense of the operational objective: Herson.

3.5. Emerging nature of the area of influence

The last element in the category of space was the effect of the area of influence (AOI) occupied by different fighting forces (Figure 3). According to AJP-3, an AOI is a geographical area where a commander can influence the enemy with fire and maneuver[36]. This element is often used in wargaming as a zone of control, i.e., an enemy unit cannot move through a friendly zone of control without slowing down or engaging in combat[37].The significance of AOI was

[34] **Wargames observation notes** 2022, entry no 3, 11, 15.

[35] **Institute for the Study of War** 2022. Russian Offensive Campaign Assessment, August 29. https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-august-29 (15.09.2022).

[36] **AJP-3**. 2019. Allied Joint Doctrine for the Conduct of Operations. Edition C, Version 1. NATO Standardization Office, LEX 5.

[37] **Sabin, P**. 2012. Simulating War. London: Continuum International Publishing Company, pp. 77–79. [**Sabin** 2012]

found to have effects on enemy maneuvers in the following manner: if an enemy unit tries to bypass a friendly units' AOI (even if the area of responsibility (AOR) of a friendly force is smaller than the AOI and the unit does not have the authority to engage outside the AOR) then the moving enemy still has to allocate its time and resources to enable such a movement because of a potential threat, e.g., conducting reconnaissance to find suitable axes, to allocate forces to guard the flank(s) and rear area, and to move into a combat or pre-combat formation, which consumes time. All these factors generated the effect that an enemy unit moving in a friendly unit's area of influence had to limit its movement range and speed (see also Figure 4).

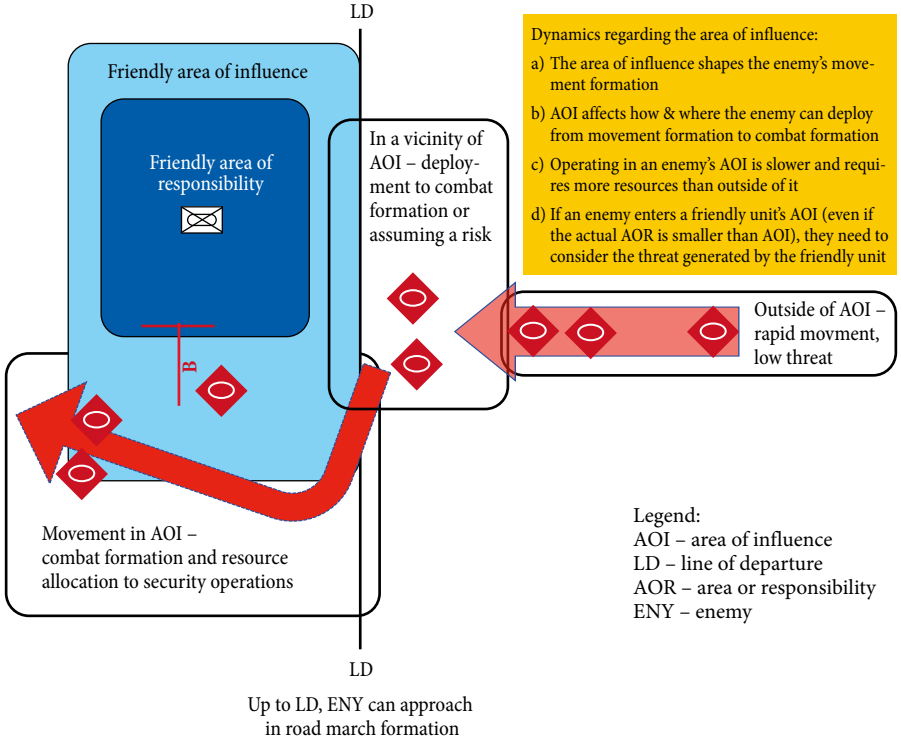


Figure 5. Dynamics regarding the area of influence. Figure by author

It also forced the enemy commander to increase resources designated to security, for example, to conduct guard as a shaping operation. The other significant element discovered was the sensor capability effect on fires and maneuver. A lack of sensors or disruption in the intelligence function could reduce the effectiveness of fire and maneuver by reducing the common intelligence picture, denying a commander the ability to generate effects against the enemy

throughout the area of influence. One good example of a well-employed unit generating effects against enemy forces throughout an area of influence with a good sensor capability and effective intelligence function is the Hezbollah operation against the Israel Defense Forces in 2006 where well-prepared units had a significant denial effect against a technically and numerically superior force using long range AT rocket systems and mortars throughout the area of influence[38].

3.6. Operational factor forces

The second category used to describe the findings is 'operational factor forces' which, according to Vego, are a deliverer of combat power[39] against an enemy in a specific environment[40]. According to Simpkin, the key attributes of military force are firepower, protection, and mobility[41]. That triangle is also a fundamental element in the wargaming paradigm which, according to Sabin, is a basis for unit design[42]. Research discovered five distinct elements in the category of forces. First, let us look at the importance of detection and delivery capabilities. Several episodes highlighted how an effective target acquisition facilitated a joint fires strike which severely hampered the enemy. This element was critical in wargames that addressed the movement of forces into a contested environment like the South China Sea or the Baltic Sea. This finding emphasizes the need for a nested ISTAR-FIRES network with multiple sensors and shooters to increase flexibility and survivability. Such an approach would demand a robust communication system, possibly employing civilian means to increase the number of sensors. The other area where the study emphasizes the importance of target acquisition and joint fire capability is the conduct of shaping operations. If the enemy possesses a significant ISTAR-fires capability, which is something that could degrade friendly forces'

[38] **Farquhar, S. C**. 2009. Back to Basics. A study of Second Lebanon War and operation Cast Lead. US Army Combined Arms Center. Fort Leavenworth, KA: Combat Studies Institute Press, pp. 7–9.

[39] **AJP-3.2**. 2022. Allied Joint Doctrine for Land Operations. Edition B, Version 1. NATO Standardization Office, pp. 19–20.

[40] **Vego** 2007, pp. III-33 to III-34.

[41] **Simpkin, R. E**. 1985. Race to the Swift. Thoughts on the 21-century Warfare. London: Brassey´s, pp. 81–82.

[42] **Sabin** 2012, pp. 47, 53.

critical capabilities well before moving out from the basing locations, this acts as a deterrence and shaping mechanism[43].

The next area described in this category is the fires and EW effects on the intelligence picture and joint fires networks (characteristic to firepower). Several cases demonstrated how the degradation of networks hampered intelligence and joint fires operations, degrading the critical capability highlighted in the previous paragraph[44]. Since connections between the sensors, analysts, decision makers and shooters all require data links, the effects of enemy fires and/or EW, attacks on such connections were critical. That aspect highlights the need to protect and maintain such links and simultaneously apply the principle of simplicity[45] to the target acquisition and joint fires concepts. Similarities can be found in the employment of HIMARS in Ukraine in July and August 2022 which, according to the ISW, degraded Russian operational capabilities like C2 and ammunition supplies[46]. One can assess, therefore, that the effective target acquisition and analysis system, which enabled the Ukrainian commanders to prioritize their limited resources and maximize the effects, facilitated those strikes.

The third area that this study revealed was cyber and EW effects against the operational mobility of a force. According to Fuller, mobility is the ability to conduct movement in contact or under threat of contact[47]. While Fuller was describing contact as an engagement using direct and indirect fire, modern warfare has added different forms of contact to the classical definition. On an operational level, sustainment and C2 systems are important enablers for mobility. The research indicated that enemy effects in the electromagnetic and cyber domains did not disrupt the commanders' ability to make decisions but had a negative impact on mobility by hampering the forces' ability to distribute information (network's ability to deliver decisions to subordinates), delaying or denying the forces' ability to carry out their orders. The principles of mission command could enable commanders to overcome such restrictive

[43] **Wargames observation notes** 2022, entry no 11 and 15.

[44] **Wargames observation notes** 2022, entry no 9, 11, 14.

[45] **AJP-01 (D)**. 2010. Allied Joint Doctrine. NATO Standardization Office, p. 1-8.

[46] **Institute for the Study of War** 2022. Russian Offensive Campaign Assessment, July 16. https://www.understandingwar.org/backgrounder/russian-offensive-campaign-assessment-july-16 (25.07.2022).

[47] **Fuller, J. F. C**. 1926. The Foundations the Sience of War. US Army War College. Re-printed 1993. London: Hutchison and Company, pp. 148–149. https://www.armyupress.army.mil/Portals/7/combat-studies-institute/csi-books/Foundationsof-Science-of-War.pdf (15.09.2022).

conditions but, as Cremin and others point out, on an operational level of war and during the employment of multinational forces, those principles might not apply to the entire force[48] because of the lack of mutual trust and understanding due to the lack of collective training.

The fourth finding in the category of forces is the degradation of combat support and combat service support capabilities under the threat of enemy contact. Some cases displayed how the possibility of direct enemy attack or being targeted by enemy fire disrupted the ability of combat support (CS) and combat service support (CSS) units to conduct sustaining or shaping operations[49]. Since the possibility of enemy effects required the CS or CSS units to employ countermeasures (like the dispersion of stock or increasing force protection elements), the ability to perform activities in functional areas also decreased, which should be understood and assessed in the planning processes.

The last element in this category was the dual effect of exposure to combat conditions on force characteristics—mainly to firepower and mobility. First, the combat experiences enabled units to increase tactical mobility by avoiding enemy fire. The experiences also enabled lethality (firepower) to be increased by providing more rapid and accurate fire.

3.7. Operational factor of time

The operational factor of time provided two examples of its significance. The nature of the operational factor of time is twofold: according to Hanska, constant time is the amount of time needed to execute activities (i.e., to occupy a line of departure), and relative time (tempo) is the speed of activities in relation to the enemy[50]. The first discovery was in the aspect of tempo. Observations indicated that rapid decisions disrupted the enemy's ability to counter them. Simultaneously, wargames showed that when trying to gain

[48] **Cremin, D.; Stewart, M.; Mills, M.; Phipps, D**. 2004. Non-technical interoperability: The challenge of command leadership in multinational operations. QinetiQ Ltd, Centre for Human Sciences, Cody Technology Park, Farnborough, Hampshire GU14 0LX UK. Paper submitted to the 10th International Command and Control Research and Technology Symposium: The Future of C2, p. 7.

[49] **Wargames observation notes** 2022, entry no 5 and 6.

[50] **Hanska, J**. 2017. Times of war and war over time. The roles time and timing play in operational art and its development according to the texts of renowned theorists and practitioners. Academic dissertation. Series 1: Research Publications, No. 12. Helsinki: Finnish National Defence University, pp. 207–215.

momentum and take initiative, commanders could get carried away and open the flanks and the rear area to enemy counterattacks[51]. This factor was especially significant when enemy forces were bypassed or enveloped but still possessed control over some lines of communication which enabled sustaining operations[52].

The other aspect—the linear dimension of time—is the season of the year, which has a major impact on operations and battles. Wargames highlighted the impact of winter, autumn and spring conditions by reducing the main characteristics of forces, primarily mobility, limiting tactical maneuvers on roads and creating operational level problems in prioritizing traffic on land lines of communication (LLOC). It also created a dilemma in terms of prioritization on an operational level: Should we provide movement priorities to combat or combat service support to units? Observations indicate that the season affected most of the forces in a negative manner and, therefore, had a major impact on the commander's operational approach. Analyzing Manninen's descriptions of Red Army operational plans in the Winter War against the Mannerheim line, it can be assessed that examples of such dilemmas were clearly present in the Red Army's offensive operations. Such an example exists in the battle of Summa, where the conditions required massing combat units to penetrate Finnish forces, but the limited LOC needed to support the traffic of the combat service support units that were sustaining the operation[53].

4. Implications for operational-tactical wargame design

This section answers the second research question by providing implications to wargame design. The study emphasizes three points for operational-tactical level game design: modification of characteristics, creation of victory conditions, and generating effects by using cyber operations, information operations and electronic warfare.

[51] **Wargames observation notes** 2022, entry no 6, 17, 21.

[52] **Wargames observation notes** 2022, entry no 3.

[53] **Manninen, O**. 2004. The Soviet plans for the North Western theatre of operations in 1939–1944. Finnish Defense Studies, no 16. Helsinki: Finnish Defence College, pp. 17–22.

4.1. Modification of basic unit characteristics

This study explains how to transform other important factors on the battlefield into the primary characteristics: firepower, mobility, and protection. Factors like morale, fatigue, weather effects, combined arms compensation[54], C2 degradation and many others should be considered during the construction of an operational level analytical wargame. One important concept emerges from such development: the balance between modifications. An effect in one area does not affect all basic characteristics equally. For example, a unit suffering enemy EW/cyber-attack reducing its C2 capability should suffer more degradation in mobility and firepower, but less in protection. The other example can be drawn out of combined arms synergy: in an attack to destroy an enemy armored formation, if an attacking unit enjoys the support of kamikaze drones, loitering munitions and attack helicopters, this should provide an advantage in firepower to the attacker because such force generates dilemmas and multiple problems for the enemy force.

4.2. Establishing victory conditions (end state)

The second concept highlighted for wargame design is the establishment of victory conditions (end state). These should be established through a combination of operational factors: time, space, and force information[55]. Victory conditions could be either a balanced combination of different factors or have one dominate. For example, victory conditions could be about a strategic narrative (information), and the time-space-force nexus could be a contributing factor. The first of these, time, could be measured as a fixed period (game turns) or be connected to the red or blue players' actions. For example, "Destroy at least 4 × enemy divisions before the enemy seizes the capital."

The second factor, force, is measured through either destroyed or remaining units or capabilities. While measuring units might be easier for gameplay, the capabilities-based assessment calculus would facilitate a better understanding of operational dynamics. The other way of establishing victory conditions in the category of force is to compare blue and red forces in designated classes/units. This option also includes a threat; the game might degrade into an attritional fight which, depending on the purpose of the game,

[54] **Leonhard, R. R**. 2012. Manööversõja kunst. Tallinn: Eesti Entsüklopeediakirjastus, pp. 110–111.

[55] **Sabin** 2012, p. 124.

could also be acceptable (for example, an analytical game). However, if the game is played for training purposes then such an attritional approach might not be desirable (for example, games used in officer education). Blue and red losses should also be connected to key capabilities, high-value targets and mission-essential equipment, which enables their actual value to be analyzed and understood.

The category of space addresses the physical location of all or some units at the end of the game. It can be related to seizing designated objectives or moving units across a line. On an operational level of war, it should address sustainment, force generation and information/political aspects: cutting off land lines of communication and thereby disrupting logistical capabilities, blocking ports using naval mine warfare, denying airports through air defense assets, or controlling a major city.

The victory condition in the information domain can be assessed using the other three operational factors either separately or in a combined manner. It can be the number of enemy forces destroyed and can also address the intensity of enemy losses as well. Both might inform the strategic narrative in the information domain. It must be emphasized that in a modern conflict the information aspect cannot be separated from the other three because it shapes public opinion both domestically and internationally. The other area where information activities should have an effect is the morale of the forces. In wargame design the effect of enemy and friendly information operations should be translated to effects on the forces' main characteristics: firepower, mobility, and protection. For example, if an enemy's information activity decreases the friendly forces' morale, they should also suffer a penalty in firepower. Another example of such an approach would be a decrease in mobility by half because the forces have been in continuous combat for several weeks.

It must also be emphasized that we need to consider the effects of the cyber domain against information flow. The key aspect of the cyber domain's effects is a unit's capability to provide effective C2. Therefore, the primary areas suffering penalties because of such cyber operations should be mobility and firepower. One way to display such an effect would be through denial of a system or a decrease in its abilities. One example of such an approach would be to deny blue players' GMLRS for two rounds because of the red players' effective cyber-attack.

A separate factor in game design is whether to brief participants about victory conditions or not, and this question is directly related to the type and purpose of the game. In analytical games designed to discover operational dynamics and to better frame operational problems or support future force

design, it is possible to leave the victory conditions open and offer only broad strategic guidance to the participants. Training-oriented games are usually conducted in a limited time frame and therefore it is more cost-effective to introduce victory conditions to the participants. However, these can be different for all sides; blue players can have terrain-orientated conditions and red players can have force-orientated ones. Such a dynamic facilitates participant assessment regarding the enemy end state and course of action.

4.3. Sequencing an operational or higher tactical echelon wargame

The last concept regarding game design in an operational or higher tactical echelon is the sequence of the game. A turn-based game would be suitable for lower tactical echelons like company or battalion. Higher levels require a different approach: sequencing through a geographical operational framework (deep, close, rear) or sequencing through combat functions. The first approach means that the game would start in deep areas, thereafter proceeding to close, and finally to rear areas. It is critical to highlight that all actions within deep, close, or rear should go back and forth between players. The other approach would build the sequencing on combat functions, beginning with intelligence, fires, and information; thereafter it would focus on maneuver and finally on protection and sustainment. The C2 step (FRAGOs, reports, etc.) could also be included; however, this requires an existing C2 structure before the game, like employing actual commanders and their staff as participants.

5. Implications for warfare concepts and force development in Estonia and the Baltic States

This section answers the third research question by establishing concepts and ideas that emerged from the findings of the first research question. The following paragraphs describe the connections between objectives and key terrains, provide connections between the sensor network, intelligence function and JFIRES assets, and finally describe emerging ideas for employing wargames in training for joint and combined arms warfare.

5.1. Identifying the connections between operational objectives, operational key terrains and tactical key terrains

The first emerging framework is connected to the operational factor of space. Based on the assumption that NATO forces in Estonia will at least initially apply a defensive posture, the value of key terrains and lines of communication should be clearly understood and assessed. The value and nature of key terrains on the lower tactical echelon is quite clear (considering the terrain of the Baltic States): they facilitate tactical maneuvers. According to Kundla, battles are often fought to gain control over infrastructure[56], which generates possibilities to conduct maneuvers against the enemy. However, on the operational level of war or even on higher tactical echelons (division and corps), the nature and value of a key terrain is more complex. Based on the findings, the analysis indicates that besides determining operational key terrains and LOC, commanders and staff should also assess their importance by prioritizing them. In addition, an assessment should be conducted on how an enemy's effects on LOC (disruption, etc.) affect operational reach—for example, how a TIM/TIC incident on a divisional MSR, which closes traffic for 24h, affects the operational reach of a brigade conducting a close fight. The other area that must be emphasized is the connection between tactical and operational key terrains. A staff assessing operational key terrains should also understand which tactical key terrains connect to it and how they facilitate maneuvers threatening an operational key terrain. For example, if a capital is a strategical-operational key terrain and an operational objective for its ports and political value, then it can be assessed that the crossroads that enable to isolate the capital can serve as the tactical key terrains enabling effects to be generated towards operational key terrains and objectives.

5.2. Establishing the sensor network to facilitate detailed target acquisition and joint fire strikes

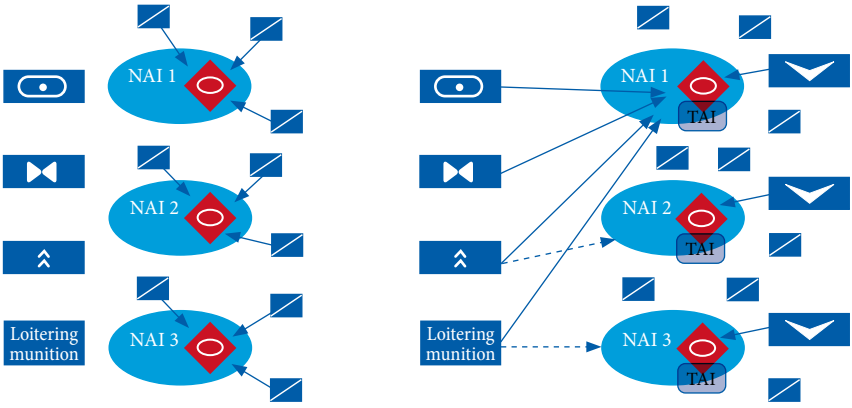
The second conclusion emphasizes the interdependence between the combat functions of fire and intelligence (displayed in Figure 5). As the findings highlighted, operating a multi-sensor nested intelligence network across the area of influence facilitates effective strikes from the operational fires' assets. Establishing this concept in the framework of Estonia or the Baltic States, local militia units (like the Defense League in Estonia or the Riflemen Union

[56] **Kundla, T**. 2017. Scouts batallion commander's study period. Tapa.

in Lithuania) can provide an asymmetrical advantage in terms of locating an enemy's critical vulnerabilities. Such local militia units could create effective sensor systems and act as a locator network which can trigger detailed target acquisition and joint fire strikes, maximizing the effectiveness of finite ISTAR and JFIRES resources. However, such a network of sensors requires robust and reliable communication systems which should be backed up by existing civilian applications like the Signal. In addition, maintaining and protecting the ISTAR and JFIRES networks should be considered as one of the priorities to enable deep operations.

Phase 1. A network of sensors will find the enemy pinpointing it down to a sizeable NAI, enabling to prioritise targets

Phases 2&3. A detailed target aquisition will be conducted in designated NAI-s. Thereafter, effects can be massed against priority targets in detailed TAI-s or separate precision attacks can be conducted



Legend:
NAI – named area of interest
NAI – target area of interest

Figure 6. Concept of multiple sensors and multiple shooters. Figure by author

5.3. Preparing for combined arms and joint warfare by employing wargames as a training method

The third implication is connected to combined arms and joint operations, and a preparedness to conduct them. Operations employing the capabilities of multiple services/arms most likely require multinational forces in the 3B framework, which require more training in limited time frames than single-nation forces because of their different capabilities and backgrounds.

At the same time, the findings indicate that enemy effects can disrupt C2 systems. Therefore, it can be assessed that realistic training against an intelligent and dynamic enemy on an operational or higher tactical level is required to adequately provide opportunities to face chaos and uncertainty, which MEL-MIL based scenarios lack. The author would like to encourage commanders and staff to embrace the idea of force-on-force wargaming, especially in a MAPEX or CAX format. Such events would help units experience battlefield characteristics, provide commanders with a more realistic decision-making environment, and enable officers and NCOs to study enemy forces and capabilities through a holistic and inclusive experience.

The other area where a wargaming approach can be useful is the force development cycle, where wargames mixed with quantitative methods can provide a comprehensive view of operational-tactical problem sets, and enable different force structures to be explored relatively cheaply. One example for an Estonian framework of a force-on-force wargame is an event where a division commander with his staff commands and controls his organic forces (blue side) and his best brigade commander with his staff goes a step farther and commands enemy forces (red side). Such an approach can be found in the US Marine Corps' force development[57] and professional education[58]. However, wargame-based training includes two major threats. First, it requires well-established victory conditions for both sides to generate enough conflict to ensure the fulfilment of the training objectives. The other threat vector in the wargaming paradigm is its human nature. Since the purpose of the game is to achieve victory (end state), it might turn into a race towards the end state, not caring about soldiers' lives or strategical narratives. As Compton emphasizes, analytical wargames should not turn into entertainment events that do not produce any innovation or tangible operational concepts[59]. Once again, the way to mitigate such behavior is to establish professional, purpose-driven and comprehensive victory conditions that force participants to come up with a professional operational design. Despite these shortfalls, wargames

[57] **Wong, Y. H.; Bae, S. J.; Bartels, E. M.; Smith, B**. 2019. Next-Generation Wargaming for the U.S. Marine Corps. Recommended Courses of Action. RAND Corporation, National Defense Research Institute, pp. 27, 45.

[58] **Lacey, J**. 2019. How Does the Next Great Power Conflict Play Out? Lessons from a Wargame. https://warontherocks.com/2019/04/how-does-the-next-great-power-conflict-play-out-lessons-from-a-wargame/ (28.09.2022).

[59] **Compton, J**. 2022. A Tale of Two Wargames: An Entirely Fictitious Tale of Wargaming Woe and Tragedy. https://warontherocks.com/2022/09/a-tale-of-two-wargames-an-entirely-fictitious-tale-of-wargaming-woe-and-tragedy/ (28.09.2022)

have a unique characteristic: commanders' decisions shape the result, and this makes wargames an invaluable tool for military education, training and force generation.

6. Conclusion

This article sought to describe the operational-tactical concepts, ideas and problem sets emerging from wargames. It also described implications for wargame design and operational warfare in Estonia. Key findings indicate the necessity to understand the connection between operational objectives, operational key terrains, and tactical key terrains. Simultaneously, the findings emphasize the interdependence between joint functions, intelligence and fires, and the nature of tempo in warfare. One overarching finding is the importance of understanding one's own and the enemy's end states and how they shape and enable a commander's operational approach. The study emphasizes the validity and utility of determining comprehensive victory conditions (end states) to facilitate a professional and holistic approach to analytical wargames, also providing a method of sequencing through combat/joint functions. Finally, this research emphasizes the importance of a multi sensor shooter network and recommends utilizing wargaming as a training, education, and analysis method for multinational joint operations to effectively generate combat-like environments.

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