Title Professional Wargaming: A Flawed but Useful Tool

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Abstract
Rationale for the Article. Professional wargames have long been an integral part of the tool set used by the military. The literature includes many examples of wargames that have been successful in terms of training, military education, procurement, operational analysis and planning for war. However, retrospective examination demonstrates that many of these professional wargames also had major errors in them and by implication current games about future confrontations are similarly flawed. Nevertheless, the academic evidence is clear that such games are still invaluable tools.

Methodology. Ten years of research into the development of wargames undertaken by the History of Wargaming Project has analysed and made generally available more professional wargames than ever before. Retrospective examination of a sample of these declassified games, from the British War Office Rules (1896) to more recent games about the Ukraine, shows significant errors. *Value.* Demonstrating that professional games had errors in the past opens challenges the overconfidence in the predictive capacity of games. It also raises the possibility for future research to identify game design bias and to develop better games in the future. Understanding the value of better games, even with their inherent issues, raise the possibility of better preparing decision makers for the future.

Notes. The words **wargame** and **game** are used interchangeably in this article. Whilst the techniques used in professional gaming evolved from modelling the battlefield, modern professional gaming is increasingly focussed on other situations that are not war, such as state level confrontations, trade wars, politics, cyber conflict, banking crisis etc. Using the term **wargame** seems inappropriate when for example, gaming a shipping dispute. All the **games** referred to this article, unless otherwise noted, are professional wargames, used by military, government, public sector bodies and other parties directly involved in real world issues. The prefix *professional* has been omitted for brevity in most places.

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Background

As of 2019, the importance of professional wargaming in NATO and allied nations is clearly on the rise. There has been a whole series of professional wargaming handbooks published; these include the US Navy's wargaming handbook (Burns et al., 2015), the United States Army War College Strategic Wargaming Series handbook (U.S. Army War College, 2015), the UK's Ministry of Defence Wargaming Handbook (MOD, 2017) and the German Army handbook (Birnstiel et al., 2006). It should be noted that there are gaps in the professional coverage, for example there is currently no equivalent

wargaming handbook for the United States Air Force. Other nations, with different military traditions, are striving to develop a wargaming capacity. An example of such a trend can be found in China, where computer-based wargames have been used to help teach senior commanders and their staff to work together, while junior leaders and soldiers are using first person shooter commercial games technology to learn about low level combat (Dunnigan, 2015).There have also been academic wargaming handbooks published that have focussed on individual methods such as Matrix Games (Curry & Price, 2014) and Confrontation Analysis (Curry & Young, 2017). New games are increasingly focussed on a wide range of situations beyond the military, such as issues around trade, banking, disaster relief etc.

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A rare photograph showing the Chinese army playing a wargame. The Chinese military cadets are playing a platoon level kriegsspiel. The opposing teams have their back to the other in order to conceal their plans Source Curry, J. & Price, T., (2016). The Sandhurst Kriegsspiel, Wargaming for the Modern Infantry Officer, Training for War: Volume 1 Morrisville, NC: History of Wargaming Project.

Successful Wargames

One of the key potential benefit of professional wargaming driving its promulgation around the world has been succinctly summarised by the phrase "Wargames can save lives." by Colonel Matt Caffrey (2019, p. 277). Caffrey has been the wargames coordinator at the Air Force Research Laboratory at Wright-Patterson Air Force Base in Ohio and a founder of Connections, an annual series of professional wargaming Conferences that have spread around the world (Connections UK, 2019). The argument that "Wargames can save lives" is supported by numerous anecdotal examples from the last eighty years of military history (Caffrey, 2019).

There have numerous well documented examples of successful wargames. Successful being defined as having training value, developing new tactics or for operational analysis which informed decision making. The recent book *On Wargaming* published by the United States War College comprehensively documented numerous examples of wargames having been an invaluable tool in the development of

equipment, tactics, national strategy and operational practise during actual conflicts (Caffrey, 2019). Many other authors, such as Perla (1990), Allen (1987), Wilson (1968) and (Smith, 2009), support this contention. The three examples are outlined below as representative of the many potential case studies in the literature.

A classic example of a successful tactical wargame that had a strategic impact was the Western Approaches Tactical Game run by Captain Gilbert 1942-45 (Williams, 1979). This trained convoy and escort ship commanders in anti-U-boat tactics during the critical convoy battles in the Atlantic during World War II. Later commentary on these games present it as only a single game (Strong, 2017), but Gilbert actually ran three types of games. The first was for the purposes of operational analysis, re-enacting recent U-boat attacks on convoys on the floor. Based on after action accounts of the escorts, Gilbert and his team of wrens deduced where the attacking U-boats could have been during the attacks and then statistically worked out the best tactic to maximize the chance of the escorts catching the attacking U-boat. The second type of game run by Gilbert was for training purposes, teaching various nationality escort commanders to apply these new tactics. The effectiveness of the new tactics in the actual Battle of the Atlantic were then then subsequently assessed on the wargames floor, leading to a Kolb type cycle of learning (Kolb, 1983). Gilbert and his team developed a new tactic, it was taught to ship captains and then their actual experiences at sea informed Gilbert's future work. The third type of game was to answer a strategic question, with a map game mimicking the actual Battle of the Atlantic with the aim of working out if the proposed plan Escort Groups (naval support groups) rushing to support convoys under attack would actually work (it did) (Strong, 2017). The games were recognised as having a major impact on Allied success in the outcome of the Battle of the Atlantic (MOD, 2017).

TACSPIEL, is an example of a tactical wargame used in 1966 for operational analysis during the Vietnam War (Curry, 2011a). It played an important role in improving the effectiveness of American Army counter-insurgency techniques. A Tacspiel game typically took two days to play just thirty minutes of simulated combat. The analysts would examine a situation such as an American infantry company being ambushed, then look at all the available evidence to identify the best response. This response then informed training and doctrine. While time consuming and resource intensive, the evidence was clear that these wargames and others from the same time period had a significant impact on the battlefield (Allen, 1987; Wilson, 1968).

A more recent example of a successful game was NATO using a computer assisted wargame, the Peace Operations Support Model. This was reported as being used twice in 2011 for commanders and their planning staff to visualise the transition campaign plan for Afghanistan. The wargame was seen as successful and was used as a case study in the MOD Wargaming Handbook (MOD, 2017). As stated above it would be possible to propose extensive lists of games that have been cited as successful in meeting the aims of the game designers. However, the three examples above, one for World War II, one for the Vietnam War and one for recent operations in Afghanistan, are sufficient to demonstrate that literature has confidence that the wargames often achieved the game sponsors aims.

Early Wargames: Experience Informed the Games

Modern professional wargames are direct descendants of some of the Prussian Kriegsspiel games of the 19th and 20th centuries. Initially, Kriegsspiel was a complex map-based training tool used by the Prussian army (Peterson, 2012). The key game mechanic was the players on each side were only told by the umpires what they could see from their simulated troop positions on the paper map. Outcomes of player decisions were determined by the umpires based on consulting detailed books of rules. The rules were based on extensive investigation into what were then recent battles and wars. To run the game required umpires—and to a lesser extent the players— to invest extensive preparation time and effort. Around 1870, the so called *free* kriegsspiel was introduced by Verdy du Vernois as an alternative (Verdy du Vernois, 1870 cited in Curry, 2011b). This method dispensed with many of the formal rules

and relied on a ready source of umpires with practical experience of actual combat in the recent past. As a result, the games could be conducted a lot faster, were more interesting and could be run more frequently (Griffith, 2009).

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Bellum, was a British simplified variant of the German Kriegsspiel. Figure 2 shows a sketch from the Illustrated London News, March 6th, 1909 (Curry, 2013). The movements of the other side are concealed at this stage of the game by the screen between the players. Relying on a good umpires' judgements rather than extensive books of rules accelerate the pace of the game and players were then more focussed on tactical decisions making rather than the rules. Of course, a poor umpire who focussed on a too rigid implementation of the rules or who saw the games as an opportunity to present their ideas, could reduce the training value by destroying the player's immersion. Source Time Life Magazine 1915 reproduced from Curry, J., (2013). The British Kriegsspiel (1872) Including RUSI's Polemos (1888), Early Wargames 2 (Morrisville, NC: History of Wargaming Project).

While the rules behind the Prussian kriegsspiel were based on recent combat experience, some other early wargames included what were, with the benefit of historical hindsight, to visualize the effects of new technologies on the lessons of even relatively recent experience. The British Army War Office War Game (War Office, 1896, cited in Curry, 2011b) is a good example. Two extracts from the umpire's guidelines on the use of cavalry illustrate this. "A frontal attack on [artillery] guns will entail heavy loss, but should not be considered impracticable." War Office (1896, p. 11, cited in Curry, 2011b).

"Against unshaken infantry a deep formation and an attack steadily conducted and carried through is required. Should the ground not admit of a screened approach or of surprise, then the cavalry must pass quickly over the fire swept ground. Cavalry attacks will always be productive, when successful, of heavy loss to the infantry." War Office (1896, p. 12, cited in Curry, 2011b).

The British experience from the infamous Charge of the Light Brigade in 1854 during the Crimean War was not reflected in the rule about cavalry charging deployed artillery from the front. Although the Light Brigade reached the guns in the Battle of Baclava, they were forced to rapidly withdraw and so had taken heavy casualties for no military gain. Similarly, cavalry charging infantry proved to be almost consistently a grave tactical error during the opening battles of World War I. The impact of these training games on the initial poor performance of the British Army in the Boer War (1899-1902) has been commented upon, but not yet researched (Caffrey, 2019). The popular and professionally respected Fred Jane Naval Wargame that was widely played between 1898 and 1918 (Jane et al., 2014) and the 1916 Chamberlaine Coastal Artillery wargame failed to acknowledge the risk of critical hits (Chamberlaine, 1916). They would be aware of this possibility, but it is currently speculation why they

decided not to include this risk in their rules. Occasionally, even powerful ships could suffer catastrophic damage where a single hit could find a weak spot in the design or a failure of training or procedures could lead to a fire that would sink the ship rapidly. At the 1916 Battle of Jutland, a failure in gunnery procedures that emphasised speed, encouraged Royal Navy crews to leave the anti-flash doors open and to adopt unsafe practises for storing cordite in corridors during battles (Friedman, 2015). The cordite caught fire easily and the open doors allowed the explosive cordite gases (flash over) to spread in moments. These errors directly lead to the loss of three capital ships and the loss of 3,309 sailors at the Battle of Jutland (Brooks, 2016). There were clearly differences between the Fred T. Jane's game and Chamberlain's game and the experience of naval warfare in World War I. However, currently there has been no academically published research relating the experience of these games on officer training to subsequence experience in the war.

US Naval War College Interwar War Games

In the time period between World War ending in 1918 and America's entry into World War II in 1941, the US Naval War College (NWC) at Newport made extensive use of gaming as the framework for the coursework during that period. These games have been widely referenced as exemplars of good practise of the use of wargames as part of the training and analysis cycle of learning (Lillard, 2016; MOD, 2017). The most commonly used evidence to support this assertion was a speech to the Naval War College in 1950, Admiral Nimitz, Commander-in-Chief of the US Pacific Fleet for WWII, who said: "The war with Japan had been re-enacted in the game room here by so many people and in so many different ways that nothing that happened during the war was a surprise – absolutely nothing except the Kamikaze tactics towards the end of the war; we had not visualised those". (MOD, 2017, p. 4) The inter war NWC games, including naval exercises at sea (fleet problems), have been well documented by surviving records such as the comprehensive work of Nofi (2010) and more summative work of Lillard (2016). The literature demonstrates that the leadership of the navy placed value in these games by the sheer scale of the effort put into them. As part of wider research on the history of naval wargaming, I have recreated played many of the professional naval wargames between 1873 and 1945 (Jane et al., 2014). My experience challenged the accepted confidence in the accuracy of these wargames. While these NWC games simulated many aspects that were in evidence in the subsequent naval war in the Pacific, some elements were incorrect. The major discrepancies are summarised in the table below. One of the surprises of the actual war was the Japanese development of the Type 93 Long Lance torpedo. Until 1943, it was not realised that the Japanese had a torpedo that had a range comparable to the gunnery range of a cruiser and the American navy attributed the torpedo hits on their cruisers to Japanese torpedo-submarine traps (the Japanese MOD 2 torpedo was introduced in 1936 and had a range of 20,000 metres and carried a 490kg warhead (Friedman, 2015). It should be noted that this was not the fault of the game developers in the Naval War College, but a failure of intelligence. The rule writers could not include weapons that they were unaware of. These are precisely the sorts of failures of knowledge and understanding that lead to flawed predictions. Technical surprises can have drastic effects on both tactics and outcomes

However, an argument based on the rules alone—rather than on the actual game results, reports, and analyses—would be flawed. The games designer writing rules had to cover the full range of potential fleet engagements, even if they did not think that situation was likely. Lillard's (2016) work showed that the wargames played were often using scenarios that were different from the subsequent war in the Pacific. Of course, sometimes the games were designed to represent less likely scenario's in order to force the participating officers to innovate when faced by the unexpected, but overall the scenarios demonstrated some misunderstandings about the nature of a future war. Despite these issues Friedman stated that it was likely that the games, using the students as researchers, made a vital difference in tactical and strategic innovation

NWC War College Game 1936 rules and scenarios	Actual Pacific War 1941-45
Anticipated decisive major fleet action between capital ships (aka Jutland 1916)	Battles dominated by air power and involved numerous smaller actions
Most gunnery actions by day	Most gunnery actions by night and Japanese proficiency at night fighting
Centralised command and control of fleets which is well suited to gunnery actions	Decentralised control was required when faced by sudden catastrophic torpedoes hits that changed the battle in moments
Aircraft had a minor role	Aircraft had major role
The concept of Convoys was absent from these games	Convoys were important
	Failure to understand the Japanese Long Lance torpedo and its effects on surface battle

Table 1. *Comparison of the United States Naval War College Wargame Rules (1936) and actual experience in the naval actions in the Pacific Theatre in World War II 1941-45. Curry & Carlson, 2019).*

Failure to understand the Japanese Long Lance torpedo and its effects on surface battle (Friedman, 2017). After criticism of the games based on examination of the rules and scenarios used (Curry, 2018), the latest wargaming books have presented a more balanced view of these wargames; the Naval War College games had errors in them, but were still very useful (Caffrey, 2019).

Fletcher Pratt was a well-known writer and respected naval wargaming hobbyist. He developed a set of floor-based wargaming rules, The Fletcher Pratt Naval Wargame, which became popular among literary and academic elites during the 1930s. With intellectual players such as Isaac Asimov, Sprague de Camp and other famous participants, Fletcher Pratt himself and others, it enjoyed success with weekly games in a New York ballroom during World War II between 1941-45 (Curry & Pratt, 2012; Featherstone, 1965.). Pratt enjoyed access to the NWC games and serving naval officers played the game, notably on one occasion, the Commanding Officer for the USN South Atlantic played with his staff (Curry and Pratt 2012). The game produced valid military insights. For example, when the Royal Navy committed a heavy cruiser and two light cruisers against a German pocket battleship at the Battle River Plate the accepted professional wisdom was that the cruisers might be lost. The Pratt game found that the cruisers would fight the pocket battleship to a standstill as happened in reality (Featherstone, 1965). Other insights included the realisation that the anti-aircraft gunnery was insufficient to stop enemy air attack, only fighter-based air defence tactics could do that. The Pratt players realised the importance of staying in formation in complex actions to avoid being engaged by friendly forces in the confusion. The Pratt games mimicked the United States Navy practise of attempted to keep centralised command, but they soon realised that in naval actions spread over vast distances, junior commanders needed to operate with a great deal of autonomy (Curry & Pratt, 2012). This was an interesting example of a hobby game that offered accurate insights, but that was not appreciated widely at the time.

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Original Sketches of the Fletcher Pratt naval wargame. Top sketch shows the player estimating range and direction. The bottom sketch shows Pratt and his wife measuring the range. The game had the unusual game mechanic of estimating range in inches for gunnery. It was a reasonable simulation of the fire control systems in use, and encouraged players to use 'ladders' of shells to determine the range of an enemy target. Once the target was straddled, the range had been 'found'. The target would then try to disrupt this by turning (usually towards the firing ship) as happened in real life. This actually introduced a diceless way of randomising gunnery due to the issues of accurately estimating the range in inches for targets up to 350 inches away. Source the Fletcher Pratt Naval Wargame (1934) reproduced in Pratt F. & Curry J. (2013) Fletcher Pratt's Naval Wargame: Wargaming with model ships 1900-1945 (Morrisville, NC: History of Wargaming Project, 2013).

Cold War, Gaming the Central Front

The Cold War lasted between 1947-1991, and was a period of geopolitical tension between Russia (and allies), and the United States (and allies). A key focus of tension was the land border between East and West Germany in Europe, where two heavily armed camps faced each other. On a number of occasions, tensions escalated between the two power blocks and a potential consequence could have been a war in Europe. The outcome of the conventional war would have been decided by a Russian invasion of Europe. Such a potential war was extensively modelled and wargamed by NATO members as part of the preparation for such a conflict (Caffrey, 2019). It would be anticipated that developments in operational analysis, historical analysis and wargaming would have created wargame models that were more accurate in predicting future combat than previous generations of wargames. Wargames were used at the tactical, operational and strategic level, in all domains from land, sea and air. For clarity, the first example is the tactical hit probabilities used for tank combat, focused mainly on the wide disparities of the estimates across the various games in the case study. The disparity in the probabilities used in at the tactical levels are clear and require no appreciation of military history to understand the point being made.

As part of extensive analytical research by the History of Wargaming Project, it is now possible to directly compare estimated performance in the different sets of wargaming rules. The selection examined were published between 1976 and 1984, the height of the Cold War as shown in Table 2.

Rule Set	Date published	Notes
FIREFIGHT	1976	USA, designed by James Dunnigan, the game development was funded by the USA Army and a declassified version of the game was also published shortly afterwards. There were limited differences between the classified and unclassified versions of the game (Allen, 1987)
DUNN KEMPF	1977	USA, the game mechanisms were a development of the hobby ARMOR & INFANTRY 1950-1975 (Barker, 1974)
BRITISH ARMY DESERT WARGAME	1978	UK, written in 1968 to game a war in 1978.
CONTACT!	1980	Canadian development of the Dunn Kempf game mechanisms
BLOCK BUSTER	1984	USA- fighting in built up areas

Table 2. *Cold War Tactical Games (now declassified).*

The following three examples were selected as they were comparing apparently exactly the same weapons/ situation as shown in table 3, table 4 and table 5. No understanding of tank combat is required to see that the estimated performance varied widely. There were also many subtler differences that were revealed during modern playtesting of the declassfied rules, such as the time required to carry out the same actions.

Situation: A Russian T62 tank (with a 115mm gun) firing at a UK Chieftain tank that is stationary at a range of 750 metres range.		
Rule Set	Combined P(hit) and P(kill) percentage	Notes
BRITISH ARMY DESERT WARGAME	96%	Single shot
FIREFIGHT	69%	40 second turn length
CONTACT!	50%	30 seconds turn length
DUNN KEMPF	6%	30 seconds turn length

Table 3: *Tank Combat, probabilities vary between 6% and 96%*

USA TOW (anti-tank missile) firing at a Russian T62 tank that is stationary at a range of 750 metres range.		
Rule Set	Combined P(hit) and P(kill) percentage	Notes
FIREFIGHT	83%	40 second turn length
CONTACT!	50%	30 seconds turn length
DUNN KEMPF	26%	30 seconds turn length

Table 4*: anti-tank guided missile, probabilities vary between 26% and 83%*

In order to increase their survival chances on the battlefield, armour often try to conceal themselves behind slopes to reduce the amount of the vehicle that can be hit. The military refer to this as the vehicle being hull-down (the American military call this defilade).

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Example of tank being seen through a weapon site. Screen shot from VIRTUAL BATTLE SPACE 1 (Bohemia Interative,2010).

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Example of tank that is hull down (defilade) being seen through a weapon site. Screen shot from VIRTUAL BATTLE SPACE 1 (Bohemia Interative,2010).

Defensive advantage for being a tank being hull down (defilade) i.e. reduce the chance of being seen and destroyed by an attack	
Rules	Combined reduction in chance of being hit P(hit) and destroyed P(kill)
FIREFIGHT	42%
BLOCK BUSTER	30%
DUNN KEMPF	10%
CONTACT!	10%

Table 5: *The defensive advantage of being hull down varies between 10% and 42%*

This article does not compare the various game kill probabilities with real results, as this would require a separate article to meaningfully examine issues around data from actual combat. Such an article would also require detailed military knowledge on ballistics. In summary, one of the issues with wargaming is calculating the chance of hitting the target and having an impact (so called effective fire). Rowlands (2006) in his book *The Stress of Battle* uses historical analysis set against analysis of training to conclude that shooting performance in live military operations was an order of magnitude worse than even the realistic training exercises; then another order of magnitude worse than range firing. Soldiers stand the most chance of hitting the target on a firing range, less in a realistic exercise and even less when they are in a real battle. The errors in the models and data employed in the wargames were not the fault of the rule writers. They were, at best, reflections of the military intelligence and analysis available at the time of their creation. This included uncertainties, errors, biases and mistakes. All of these flaws, real and potential, would have influenced the real dynamics of player decisions to a lesser or greater extent. Often at the tactical level they will play a substantial role. This article does not explore what impact these errors in the physics of combat had on what the players took away from these various games in terms of operational as well as tactical insights. That topic is an area for further research.

Cold War Operational Front Games: All Wrong?

As part of wargaming based research I was using the hobby wargame MEGABLITZ to develop a further understanding of the hypothetical conflict during the Cold War (Gow, 2004). The game was played on a map, and unusually for a hobby game, logistics were a key part of the game, with units of trucks being essential to continually resupply the front line with ammunition, fuel etc. If a player did not have sufficient supplies, their forces were unable to move and attack. Playing the game rapidly identified that even supplementing fuel and food supplies with looting, the Warsaw Pact (Russian coalition) did not have enough trucks to support their forces. In 1980 Russian tank division needed 1073 tons per day for offensive operations and they were supplied by 1,500 vehicles per division (Dunnigan, 1982). However, prior to the Arab Israel War of 1973, they had just 250 per division. The mathematical conclusion is that until the mid-1970's, if the NATO defenders in Europe had fought (forcing the advancing Russians to use up supplies), the attack would have run out of supplies in three days. It is likely that the British, American, West German and other NATO nations would have seized this opportunity to counter attack the out of supply enemy forces, leading to a rapid conclusion to the land war.

Research by the History of Wargaming Project has found that the majority of the Cold War operational level games from this era are still classified, their records lost or otherwise unavailable in defence academy or think tank archives. However, there is sufficient evidence to conclude that the critical flaw in Russian forces was the lack of trucks was not reflected in the wargames. For example, neither the British Army Wargame cited in Curry (1956) or Theatrespiel (1965) covered this area. Commentators on the Cold War games such as Allen (1987) or Wilson (1968) did not mention this issue. Hobby wargames about the central front, from well-respected designers such as James F. Dunnigan, did not highlight this weakness in WARSAW Pact forces prior to the mid-1970s' (Dunnigan, 1973). Examination of wargames modelling air and naval operations from the same era supports the evidence that some professional wargames of the Cold War had major errors in them.

Games on Ukraine Crisis

All militaries use wargames as part of their planning cycle for potential future conflicts. Understandably the current professional wargames are usually not available in the public domain, though summaries that are indicative of design and application are available from the Connections series of conferences and other public domain sources (Connections UK, 2019). Most professional games are being driven by innovation in designs from the hobby space and commercial games companies, such as new methods of gaming such as matrix games (Curry & Price, 2014), confrontation analysis (Curry & Young, 2017) and role playing. Therefore, if one knows that a particular professional wargame was designed as a certain genre of game, then an experienced game designer has a strong outline of the game mechanics without access to the actual game materials.

The Ukraine Crisis from 2014 onwards became the War in Donbass. Fought between the Ukrainian government and Russian supported separatists, the conflict become a short high intensity war that after numerous cease fire attempts has dwindled to a low-level disputed border conflict with sporadic skirmishes. The conflict was anticipated and was gamed prior to the conflict. Without referring to classified wargames, it is possible to look at evidence that showed that the wargame models built prior to the conflict also had errors in them. The board game *Millennium Wars: Ukraine* (2003) by one of the best-known military board game designers, Joseph Miranda, was published ten years before the actual crisis (Miranda, 2003). The game had many interesting features, but the assumptions about the scale of the war were completely wrong. The game postulated that Russia would deploy perhaps 150,000 troops and NATO would immediately commit an equal sized force. The game mechanisms showed a kinetic war similar to that anticipated in the wargames for the Cold War Central Front. The actual conflict involved largely small units, new technology such as drones, and both sides strategy included a focus on the international opinion, attempting to win the war through dominating social media.

On the very eve of the war, Brian Train, widely seen as one of the top counter insurgency game designers, published a game on March 16, 2014 about the potential conflict (UKRAINE CRISIS, 2014). Subsequent changes by the designer to the game to reflect the actions of the real world included

- Airfields added to Kiev and Odessa to help the Ukrainian parachute brigade to move.
- The geography of the map was changed with the addition of an explicit Sevastopol enclave.
- Expansion of non-kinetic options, as the war was being waged on more than just the battlefield.

The game was according to game designer “half right and half wrong” (TRAIN, 2018). The tentative conclusion from these two examples is that even the current generation of wargames are not necessarily reliable simulations of conflicts that have not yet occurred. Having shown how a lack of or faulty intelligence often drives the failures of games, it is hardly surprising that hobby games are also poor predictors.

Computer Wargames

Computer wargames are an essential part of military wargaming. For example, flight simulators, tank simulators, operational games and tactical combat. It should be noted there are differences between a simulation (designed for evaluative or computational purposes) and a game that is designed for educational purposes. Whilst having many advantages, it is also recognised that the closed nature of the software driving the computer game make it harder to check the under-pinning assumptions (Sabin, 2012). VIRTUAL BATTLE SPACE 3 (Bohemia Interactive, 2018) is a widely used tactical trainer and is based on a commercial computer game engine Arma 3 (Bohemia Interactive, 2013). Used by the British Army, Australian Army, New Zealand Army (Bohemia Interactive, 2019), it has undoubted training value. My observation of its use show that although the game is run in real time (i.e. if it takes 5 minutes to move a certain distance in the real world, then the players take 5 minutes to move the same

distance in the game world), it does not reflect time accurately for low level combat. As the players are interacting with game in a computer laboratory, they are in close physical proximity to the others in their team. This allows orders to be given faster, players communicate faster and after an action, such as storming a building, they reorganise more rapidly. In real life, soldiers are more spread out, are distracted and so communication often takes longer. After storming a building, typically the attackers are shaken, their ears ringing, dust and confusion means that sorting them out ready for the next action takes far longer than typically happens in VBS 3 games in the classroom.

The value of computer games technology in the military context has been questioned (Whitney et al., 2013). I analysed a well-established modern computer tactical trainer was for this research. Used to depict unit level actions from platoon (30 men) to brigade (3000 men and vehicles) it used individual avatars i.e. every soldier, civilian and vehicle is modelled. The issue with this is the time for actions was distorted. In the real world, the time for a platoon (30 men) to attack is faster than for a company (100 men) or brigade (3000 men). However, in the game, the avatars responded to player orders at the same time, potentially misleading the players into how long such actions would take in the real world. The same trainer also generalised woods into light and thick woods. From the military perspective, woods are more complicated. Mature woods have large trees, but the crucial question is there wide enough gaps for vehicles to drive through the woods? Less established woods have smaller trees and the crucial question is can armoured vehicles crush these saplings and drive through the woods? UK Forestry Commission Woods often have cuttings (gaps) though them in parallel lines, making them suitable for vehicles to drive through. This micro level of detail is essential if the game is to teach the correct tactical lessons.

The Value of Professional Wargaming

Having raised examples of significant errors in the wargaming rules written to model future conflicts, it is necessary to balance this with a summary of the wider academic evidence on the value of such games. It should also be noted that the various official practise handbooks of wargaming also offer support on the value of wargaming (Birnstiel et al., 2006; MOD, 2017; U.S. Army War College, 2015).

- It has long been realised that the act of designing a wargame, whether boardgame, miniatures rules or narrative game, is a way of creating a comprehensive analysis of a situation (Dunnigan, 1977, Sabin, 2012). The act of building a wargame has a value as an analytical method. Burns et al. (2015) went further and stated it can be considered an approach "for exploring complex problems, and is a form of applied research" (Burns et al., 2015, p7).

- State level confrontations are complex; at tactical level they included issues of space, time, forces; at a strategic level they may also include imponderables such as national will, supply chains (logistics), political considerations and international law. Wargames are an established way of visualising such complex problems in a single model (Caffrey, 2019; Perla & McGrady, 2011; Sabin, 2007).

- Given the rise in confrontations and crises facing nation states, particularly those fraught with a potentially high cost of failure, it is reasonable to take every opportunity to better prepare leaders. Wargames are a way of training decision makers in non-judgemental environment, where they can test ideas (Duke & Geurts, 2004; Perla, 1990).

- Having played wargames can be a part of developing the mental agility of leaders to cope. when faced by the unexpected in crises (Cancian, 2018).

- The early Prussian Kriegsspiels were clearly a way of the experienced bringing their knowledge into the classroom. There is wide evidence that the environment of a game encourages participants to share experiences (Brightman and Melissa Dewy's, 2014).

- Participating in a game can be part of the essential team building as preparation
- for a crisis (Caffrey, 2019; Perla, 1990).

- Games are a well-established way of teaching and understanding history (Dunnigan, 1977; Sabin, 2007, 2012).

- A less obvious point is that games are an invaluable way of developing an understanding of the other sides (so called Red Team's) perspective. This value of this should not be underestimated, as a better understanding of other stakeholder's world view can help prevent a crisis inadvertently escalate (Hoffman, 2017).

The games represent the decision spaces and possible consequences of those decisions in ways that are valuable experiences for the players. The players learn what information was important to making a decision and how to acquire and evaluate that information.

Conclusions

It is well established that game designers can build games that are often accurate representations of past conflicts. Games can have a wide variety of purposes, such as focussing on political, logistics, decision making etc. and hobby game designers have a developed a range of game mechanisms to simulate their area of interest. To keep the game playable, designers can abstract or generalise the areas of less interest for their purposes. This research into the application and practise of professional wargames, from the early days to more recent examples, show that some have included significant errors. The case studies of tank combat modelling from the Cold War unequivocally demonstrate substantial inconsistency. Professional wargames are valuable tools for the military but not because they are necessarily accurate at modelling all (or any) aspects of future warfare. Indeed, the historical record indicates that more often than not professional games are flawed in much of their assessment of future outcomes of conflict from the lowest to highest levels. The wider academic evidence on the use of games shows they add value to training and help practise decision makers in their core role of make decisions under pressure. Gaming helps leaders to be better developed, prior to conflict, than typical qualification programs and individual study can achieve. What is needed to make better professional games in the future is comprehensive studies of large samples of historical professional games to examine how they differed from subsequently reality. Historical in this context refers to any game that has been run in the past and is no longer used. First it is necessary to identify past errors and their sources before we can both fix those and anticipate new ones in the future. Knowing how aspects of games, such as morale, movement, combat, politics etc. have been wrong in the past, will allow game designers to be aware of previous bias tendencies and mitigate these in future designs. One area of particular importance are geopolitical games, where state level issues are gamed, countries policies informed and decision makers trained. Knowing what the errors were in historical POL-MIL (Political-military) games could help avoid them in the next generation of games about anticipated real world issues. The importance of decision makers at nation state level being better prepared through better games is potentially important to us all.

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