Achieving game goals at all costs? – the effect of reward structures on tactics employed in educational military wargaming

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Abstract

A key motive in using gaming for educational purposes is to enhance user motivation and involvement to the subject matter. Within military education, games have always been utilized as a means to think clearly about military operations. However, some research results have shown that gaming, regardless of what the game is supposed to portray, is a meaningful activity in itself, and this can distract the learner away from the educational objective. Playing the game, then, becomes similar to competition, such as in sports where the objective is to *only* win the game. The player directs actions to achieving game goals even though some actions are inappropriate from a learning perspective. To shed light on the discrepancy between playing a game to win and playing a game to learn, we conducted an experiment on cadets playing an educational wargame. By varying the conditions of the game, playing with or without points, while still in line with the learning objective, we were interested to see what impact it had on the tactics employed by cadets. The results showed that adding reward structures, such as points, changed the outcome of the game, that is, groups playing with points played the game more aggressively and utilized the military units more extensively. These findings suggest that changes in the game design, although educationally relevant, may distract learners to be more oriented towards a lusory attitude, in which achieving the game goals becomes players' biggest concern.

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Introduction

Educational gaming is an experiential exercise in which the purpose is to learn from this experience (Gredler, 1996). A motive in utilizing games in education is to enhance user motivation and involvement. However, gaming can also introduce artificiality to the learning activity as users make an effort to achieve the game goals. Although these goals are designed with the learning objective in mind, there is no guarantee that players will exhibit a behaviour in line with the purpose of training. Eagerness to reach game goals can lead to a player behaviour that jeopardizes the learning objectives (Rieber & Noah, 2008), as gaming becomes a meaningful activity in itself regardless of the reality it represents.

In the military, games have been used for centuries as a means to think clearly about military operations (Smith, 2010). In educational wargaming, officers are challenged with real-world problems by facing an adversary in the game. Wargames are not used to enhance user motivation or engagement, although they may afford participants a great deal of satisfaction (McHugh, 1966). The purpose is to stimulate officers into tactical thinking and decision-making that corresponds to real-world situations without paying the real-world penalties (Perla, 1990; McHugh, 1966).

Despite the military's long tradition of using games, the unwanted behaviour of gaming only to win also occurs there occasionally. The artificial and safe environment provided by wargames may lure players to behave differently compared to the real world, which is exemplified by being over-aggressive and a tendency to take higher risks (Lind, 1985; Rubel, 2006). The safe environment where players do not need to suffer real-world consequences seems to influence them into higher risk tendencies. Furthermore, the game environment appears to shape player behaviour in unwanted directions, as they want to overcome their opponents by using tactics not in accordance with military doctrines.

Consequently, educational wargaming requires more from its learners than just playing a game. Players need to take on two coexisting attitudes towards the activity. First, they must act and think as officers and take on a professional attitude towards the activity. Second, as wargaming involves playing a game, the user must also take on a lusory attitude (Suits, 2005) towards the activity. A lusory attitude involves committing to play the game in ways defined by the game rules and can be seen as a social contract that articulates the restrictive use between players and the game. From an educational perspective, playing wargames, thus, means that officers must maintain a balance between these attitudes throughout the game or else there is a risk that both the learning experience and the gaming experience get compromised. Gredler (1996) warned about this kind of mix between experiential simulations, where participants take on serious roles, and games, which place them in direct competition with each other. According to Gredler, this will create a mixed-metaphor problem, in which two conflicting messages will be sent to the learner. The learner is supposed to play out the roles, but

a focus on who the winner is in the end may distort the simulation experience and become detrimental to the learning process.

We wanted to explore this delicate balance between lusory and professional attitudes in an experiment among military cadets by focusing on the competition aspect. We manipulated the computer wargame by adding educationally relevant game points to the scenario to see whether this feature change had any effect on how the operations were conducted, that is, what tactics were employed. Specifically, the objective was to see if the tactics employed were a result of a change in balance between professional and lusory attitudes. As in any learning situation, learning is dependent on many various factors, and a player's behaviour can be corrected by close facilitation and debriefing. However, in this experiment, we focused on a single factor, the game design, and asked ourselves what effect game-like features have on player behaviour as we argued that player behaviour not in line with educational goals is less desirable and creates unnecessary difficulties. Furthermore, it is very common that commercial games used for educational purposes are equipped with reward structures, so our interest on effects to player behaviour addresses a wide audience. The setting was an undergraduate course where cadets used a commercial wargame to learn about combat at battalion level. In this sense, the educational setting was normal with the exception that half of the course participants played an altered version of the computer wargame.

Method

Participants

Eighty-one cadets (8 women and 73 men, aged 22 to 36 years) from the Swedish Military Academy participated in the study as part of an eight-week course in war sciences. The participants had served in all branches of the Arm

Game and scenario

The experiment used a commercial strategic turn-based game, THE OPERATIONAL ART OF WAR (Matrix, 2005). The game was chosen for this course, as it contained all the necessary attributes associated with battalion combat, was fairly easy to use, and enabled training of the whole class simultaneously. The game map consisted of hexagons, and in every turn, the player gave orders to subordinate units. When players were done, the turn was evaluated, and the results of the players' actions were displayed on the screen. The results were then sent to the opponents who started their next turn.

The game allows the instructors to create customized scenarios. The scenario for the course, Operation Pajazzo, was created to match the learning objective and cadets' prior planning phase. Operation Pajazzo was made as a head-to-head battle (at battalion level) with comparable forces on the Blue and the Red sides. Blue's mission objective was to take and hold a valley south of Rome to prepare later advancement towards Rome. Red's mission was to block this advancement. Both sides controlled a mechanized battalion, but because the Blue side had an offensive task they were provided with more companies vis-a-vis the Red side to balance out potential disadvantages. The challenge for both sides was to command their units in tactical ways to take control of the valley. This meant, among other things, to move units in such ways that local supremacy could be reached, coordinate indirect and direct fire, keep the supply chains intact and maintain the combat effectiveness of the troops.

Design and measurements

The experiment utilized a between-subjects design. The independent variable was the explicit reward structure in the game, whether if the game was played with or without victory points.

The participants were randomly assigned to teams of two or three people and then each team was randomly assigned to one of the two conditions. For the experimental group, some of the hexagons on the game map were associated with points, that is, victory points. The scoring hexagons were selected in line with the mission objectives for each side, with certain vital hexagons in the central valley resulting in points. A hexagon's score was awarded to the side that possessed the hexagon at the end of a turn. The overall score for each side was calculated between the turns and was only made visible to the player at the beginning of a turn. The control group played without points. As the computer game normally used scoring to keep track of which side was winning, playing without victory points meant that the game could only provide players with information that the game was a tie. Although the experiment group played with points, they were given same instruction as the control group. They were both told that the objective of the game was specified in the military orders.

We were interested in measuring the effect that victory points had on the tactics employed, if we could see indications of a change in balance of a player's lusory and professional attitudes. One way to analyse the tactics employed is to observe how the players make use of the military units, especially the players' choice of maintaining unit strength, readiness, and health. The *Unit Health* in the game represents "…an average of the unit's supply, readiness, and a fraction of assigned vs. authorized equipment" (Matrix 2005). Health is, thus, a result of how much the unit has been engaged in combat, subjected to indirect fire, moved, or provided supplies. A low value means that the unit has been utilized extensively, and this can be a sign of a lusory attitude for two reasons.

First, in games, generally, players adopt a strategy that exploits the rules to achieve game goals. Earlier results from educational wargames (Frank, 2012) indicate that players utilize all military units at player disposal to achieve the game goals, even if this use is in conflict with military doctrines. Examples include giving a support unit (engineers, headquarter, artillery, medical and logistics units) with limited fighting capability an offensive attack order against a superior enemy, or to expose military units to unnecessary risks just to gain victory points in the game. This is generally not advisable from a tactical perspective and will decrease the health value. Measuring and comparing *support units'* value will help expose this issue.

Second, Operation Pajazzo is only a small part of a larger military operation that the cadets need to take into account when they plan and conduct the operations. A risky tactic is to exhaust units within the time allotted, possibly just to fulfil the game goals for Operation Pajazzo, but neglecting the fact that the units are to take part in the next stage of the operations. Measuring the Unit Health among *all units* will help reveal whether or not players are keen on preserving strength.

Furthermore, military doctrinal rules emphasize the importance of *sustainment*, which means that own forces need to maintain combat readiness over time. Consequently, the military units' state at the end of a game session, especially units' health value, will mirror the players' ability in addressing sustainment and how keen they were in following these doctrinal rules. Thus, the dependent variable is the mean of the Unit Health among all units and support units that we assumed would reflect the tactics employed during the game round.

Procedure

The wargaming session was the last phase in the advanced course of military tactic. Prior to the gaming session, cadets were separated into groups to plan Operation Pajazzo using predefined planning procedures and to learn about the units in a battalion. Prior activities also included field exercises that taught the cadets how the terrain must be taken into account in tactical thinking. Thus, cadets were familiarized with the terrain and with the capacities of the military units as well as the task of Operation Pajazzo. Before playing the Operation Pajazzo wargame the cadets were given 2 to 3 hours to play a tutorial scenario to learn how to play the computer game. After training the experiment began. The participants played the game in groups of two to three people in duels – Blue side against Red side. Each group played the same scenario for three rounds, shifting sides between Blue and Red after each game. This meant that half of the groups played Blue twice and Red once, and the other half played Red twice and Blue once. Between each game the opposing team was shifted so no team met the same team twice. This was done to avoid getting familiar with opponents' strategies and tactics. After each game

round, there was a debriefing and reflection phase assisted by instructors to discuss lessons learned.

Results

To measure Unit Health after each game round, the file containing the last move was loaded into the game. Each and every unit was measured and given a point corresponding to current health status. In the game, the Unit Health is indicated by different colours, green to red, and these colours were converted into numbers, zero to five, where zero indicated an evaporated unit and five a unit with full health. A mean value was calculated for each side using the scale provided above. However, we were also interested in knowing how each team made use of support units. Therefore, a separate mean value was calculated, which only included engineers, headquarter, artillery, medical, and logistics units. Though it was tempting to compare the mean values of the two sides, problems arose due to the close dependency within a duel. The Blue side's actions would affect the Red side's responses, which in turn would affect Blue's next turn. Therefore, to obtain independency between measurements, a mean value was calculated for each match, including both Red and Blue sides. Additionally, as the same participants were included in all three game rounds, separate analysis was performed for each game round. Table 1 below summarizes the results.

Table 1. Comparison of Unit Health values in wargaming matches with and without points

	All units		**Support units**	
Game session	Without points	With points	Without points	With points
First round	n = 5	n=10	n=5	n=10
M	1.39	1.17	1.62	1.21
SD	0.26	0.35	0.32	0.29
Second round	n=9	n=10	n=9	n=10
M	1.31	1.18	1.42	1.12
SD	0.23	0.29	0.21	0.34
Third round	n=9	n=10	n=9	n=10
M	1.42	1.06	1.34	1.05

SD	0.31	0.22	0.31	0.22

All units. For each game round, an independent two-sample t-test was performed. Results showed no significant difference for first and second game rounds (t=1.26, df=13, p=0.23) and (t=1.02, df=17, p=0.32), respectively. The number of observations in the first round was fewer (n=5) compared with other rounds, as four matches were disqualified because they did not finish all eight turns within the time allotted. The results for the last round showed a significant difference between matches with or without points (t=2.94, df=17, p=0.01). Effect size (Hedges' g) for all three rounds ranged from medium effect size (0.7 and 0.5 for first and second rounds, respectively) to large size (1.4 for third round). The results suggest that even though there was no significant difference in first and second rounds, there was an effect of health decrease in all rounds when playing with points.

Support units. The independent two-sample t-test conducted showed significant differences in support units' mean health in all three game rounds. The first round generated values of t=2.44, df=13, and p=0.03, between the group that played with points and the group that played without. The second and third rounds also yielded results that were significantly different at similar level between the groups – (t=2.26, df=17, p=0.04) for the second and (t=2.36, df=17, p=0.03) for the third. An estimate of the effect size yielded the following values: d=1.33 for the first round, d=1.04 for the second, and d=1.08 for the third round. Hence, the effect size was large in all game rounds.

As a result, all game rounds played with victory points had, on average, lower health status among units compared with groups who played without victory points. Even though this difference was marginal in the first and second rounds, when comparing all units, the third game round produced a large difference. Furthermore, there was a large effect and significant difference in all three game rounds when comparing support (non-fighting) units between groups. In summary, playing with points had a negative influence on all military units' Unit Health, which supported earlier results that players expose units to risks, such as attack and move orders, when playing with points. This was particularly true to support units, suggesting that players employed tactics not in line with doctrinal rules.

Discussions

In this experiment, we investigated the effects of tactics employed when manipulating underlying reward structures in a wargame used for an educational purpose. By comparing game matches, played with or without victory points, our focus was

whether or not there was a difference in how the military units were utilized. After each game round, the health status of each military unit was measured, with the assumption that this value represented how the unit was utilized during a game round. Results generated in comparing matches between the conditions showed a large difference in mean values of the units' health status. Reward structures and receiving points for conquering vital hexagons resulted in significantly lower Unit Health mean values, providing evidence that different tactics were employed as compared with matches where no reward structures were used. One explanation of the extensive use is that players with reward structures are being more aggressive and, therefore, utilize their units to a larger extent. In addition, as the support units yielded low Unit Health values, the results indicated that players with reward structures did not differentiate between combat and support units. This confirms results from earlier studies (Frank, 2012) that players, who get carried away by wargaming, disregard what the support units in the game are meant to represent and use them as generic fighting units.

As players in these cases do not prioritize unit rest, recovery, and strength, the results can be interpreted that the players are more aggressive because they are more oriented towards achieving the game goals. They are employing a tactic where they are willing to pay a much higher prize to achieve their goals. Whether or not this is desirable depends on each individual situation. However, this high-risk tendency is a result of a change in balance between lusory and professional attitudes and, therefore, suggests, in general, a non-admissible behaviour.

Arguing that players will employ a different tactic when the game is modified might be trivial. However, we focused on modifying the game in ways that the added reward structure was congruent with the mission objective and, thus, was educationally relevant. Strategic and vital regions on the game map associated with victory points, and yet, this minor modification, in line with the overall task, generated a change of how the units were treated. Players seemed to adopt a different interaction pattern when victory points were introduced in the game. This adaption becomes clear when we observe game round three, in which there is a significant difference between the conditions. Furthermore, in game round three, the standard deviation was among the lowest for the groups playing with points, while the spread fluctuated more in the other condition during all three game rounds. This suggests that the victory points shaped players' behaviour into a gaming-specific interaction pattern; they learned a specific way how to treat their units. Possibly, additional game rounds would shed some light to this observation.

This study confirms warnings from Gredler (1996) to mix experiential simulations (role playing) with games (competition) to its participants. However, warfare *is* by nature a competition between the fighting sides where the objective is to overcome the opponent. Training warfare with wargaming must, therefore, include techniques to balance players' attitudes. Better design, such as elimination of victory points, is one such aspect supported by the results from this paper, but another solution is to have instructors nearby to monitor the gaming process and

steer players' reasoning into the right directions as it happens. Although this is perhaps the most efficient remedy to the problem, there are practical obstacles, such as the availability of instructors required. Often in learning situations, as in our experiment, instructors are a limited resource, especially considering having enough to closely monitor every game round.

Furthermore, this study suggests that wargaming with explicit reward structures becomes a meaningful activity in its own right, potentially suppressing the relation between game and the real world. Instead of being a representation of real military units where doctrinal rules regulate on how to make use of them, they became game pieces in an activity only to be won. Winning the game by points was never mentioned prior the game sessions, the only instruction given to the groups was to follow the military orders. But the indication that the experiment group followed an objective to win the game by points suggests that the game goal were more powerful than to follow doctrinal rules. From a game perspective this is perfectly sound. Salen and Zimmerman (2004) argued that games create their own meaning and provide their own goals. However, from a learning perspective, the results are not in perfect line with Cordova and Lepper (1996) arguments that congruent learning and gaming goals should result in increased learning.

Caution must, therefore, follow ambitions when using commercial games in military training, as these games are designed for entertainment and generally equipped with explicit reward structures. Well-designed games do not guarantee that the tactics employed by the players are in line with the learning objective.

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