Warfare Training With Game Consoles:
Training without Getting Your Hands dirty!

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Abstract
Over the last decade the view on games has changed. Computer games are no longer only used for entertainment, but also for scientific and educational purposes. During the last three years several studies with commercial games have been carried out at the Swedish Defence Research Agency (FOI), at the department of Man-System-Interaction (MSI), to study decision making and different command and control issues. Efforts have also been made to investigate if commercial games can be integrated with existing military systems and used for training and education. In August 2003 a comprehensive study was carried out with over 50 cadets at the Swedish Army Combat School, MSS Kvarn, in Linköping. The aim was to investigate if it is possible to combine a field exercise with a similar exercise performed in a game based environment with COTS products. The game Ghost Recon was used on three different game consoles and on PC. The cadets’ mission was to carry out different tasks involving communication, approach march and enemy contact in combat pairs, both in a live fire exercise and in the game based simulation. Both exercises were supervised by instructors from MSS Kvarn. After the exercises the participants filled out a number of questionnaires. Results show that most participants are positive towards the idea of combining field exercises with game based simulations in training of certain tasks in their education. The participants stated that game based simulations can be a useful tool to practice skills like giving orders, skills that they can later use in the field. The results also show that the participants believe it can be useful to practice communication in a calm environment even though they find it problematic not being able to use hand signals and visual signals in the same way they do in the field. The main conclusion from the study is that games like Ghost Recon, with no modifications, with advantage can be used for combat pair training. However, the role of the instructor is very important. An interesting future work would be to conduct a similar study with squad leaders.

Introduction
Many people find different kinds of games amusing and entertaining – something they do in their spare time. In Sweden students use computers more and more, and they spend, on average, more than two hours a day on entertainment\(^1\): playing games, listening to music, editing digital photos, etc. (see SIKA; SCB). However, computers and computer games are not solely used for entertaining purposes. Over the last decade the view on games has changed. Computer games are no longer only used for entertainment, but also for scientific and educational purposes (Calvert, Jordan & Cocking, 2002; Crawford, 2003; Macedonia 2001). During the last three years several studies with commercial games have been carried out at the Swedish Defence Research Agency (FOI), at the department of Man-System-Interaction (MSI), to study

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\(^1\) The average time (127 minutes) is based on male students, in the age 16-24, that have a computer
decision making and different command and control issues. A number of different games have been used for different purposes. Among other things, several first person shooter (FPS) games have been used. In the spring of 2001 a study with Delta Force 2 was carried out (Kylesten & Hasewinkel, 2001). The purpose of that study was to evaluate these kinds of games and to investigate whether or not they can be used to study issues like command and control, decision-making, cooperation and communication. The results from the study were encouraging and showed that FPS-games have many good qualities and can, in many respects, be viewed as a micro world or a low budget simulator, as long as their limitations and shortcomings are taken into account (Kylesten & Hasewinkel, 2001). Since then, FPS-games have been used for several different studies in Sweden at FOI. During the summer of 2001 a comprehensive team performance study with 120 participants was conducted with the game Operation Flashpoint (Berggren & Andersson, 2003). The purpose of the study was to investigate how mutual understanding within a team, i.e. mutual expectations on performance affects team performance. In order to study this phenomenon a dynamic environment was needed where the participants were forced to take action continuously throughout the experiment. Operation Flashpoint offered such an environment.

Efforts have also been made to investigate if commercial games can be integrated with existing military systems and used for training and education. One of the goals is to investigate whether or not it is possible to use the traditional command and control systems on commercial game hardware, for example Xbox, to reduce the need for expensive computers. This was initially tested in the spring of 2003 at K4, Norrlands Dragoon Regiment, in Arvidsjaur in the north of Sweden. In this study three separate taskforces were led by a ranger staff battalion who operated their ordinary command and control system. The taskforces had three separate missions that they carried out in three different game based simulations (GBS) using three different FPS-games; Delta Force, Ghost Recon and Rough Spear. Each taskforce were connected to a LAN of either Xboxes or PCs. The exercise turned out well and the participants performed, to what extent they could use the same skills in both environments and also investigate whether or not they found the exercises educative. In the study 55 cadets participated (53 men and 2 women). Their average age was 23.13 years (std: 2.06, min: 20, max: 31). The cadets’ mission was to carry out different tasks in combat pairs, i.e. they were to practise communication, approach march and enemy contact, both in a live fire exercise and in a game based simulation, GBS. A within-group design was used, i.e. all cadets participated in both the field exercise and in the GBS. Sixteen cadets participated in the GBS first and 39 cadets started with the field exercise. Each exercise, including time to fill out a number of questionnaires, took approximately four hours, thus all combat pairs participated roughly eight hours.

The live fire exercise was part of the cadets’ ordinary education program and was planed and led by instructors from MSS Kvarn. During the exercise the cadets were to practice skills like communication, approach march and enemy contact. The cadets worked in combat pairs and participated in groups of approximately 20 people.

The GBS was initiated by researchers from the Swedish Defence Research Agency, FOI. To make sure that the GBS would become meaningful and somewhat realistic it was organized and carried out in cooperation with MSS Kvarn. Tom Clancy’s game Ghost Recon (see Ubi soft entertainment, 2003) was used unmodified on three different consoles (Playstation 2, Xbox, Game Cube) and on PC. The game was chosen because it is available for all four platforms. Also, it takes place in an environment that is fairly similar to the environment the participants encounter in the live fire exercise and it is possible to apply some tasks, or training objectives, in both environments.

Before the GBS was carried out the cadets were asked to fill out a short questionnaire. This was done to assess their

A Study with FPS-games

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2 Commercials Of The Shelf, i.e. products that are available to consumers, usually to a fairly low price.
3 A total of 56 cadets participated in the game based simulation, but only 55 participated in the field exercise. Since the study is based on the participants’ experiences of both exercises, the results from the 56th participant was excluded.
4 The study had a second aim; to evaluate pros and cons between different game consoles, which is why four different platforms were used. The results from that evaluation will not be discussed in this paper.
computer and gaming experience. In the GBS the cadets worked in combat pairs and participated in groups of eight people. Each combat pair had to solve three objectives on each platform within a time limit of 20 minutes per platform. Before each mission was carried out the cadets got to practice in a training scenario. The conditions for the mission, and orders, were given by MSS instructors. The instructor also emphasized that the purpose of the exercise was not to “win the game” but to handle the mission in accordance with military rules and regulations, i.e. they where instructed to use correct commands when they communicated and to advance in an appropriate way. Three different instructors participated in the study, thus, the same instructor was not present during all GBS sessions.

It should be mentioned that the GBS was not part of the cadets’ ordinary education program and therefore the cadets’ did not get as much guidance and feedback as they would normally get in a training session. The primary purpose of the study was to explore the possibilities of using COTS products for training exercises and to investigate whether or not it is suitable to combine field exercises and GBS’. Thus, the live fire exercise was more focused on training than the GBS.

When the cadets had carried out both the live fire exercise and the game based simulation they filled out a questionnaire. In the questionnaire they rated their own communication, approach march, enemy contact and their overall performance in both exercises. They also rated to what extent they found the exercises educative, meaningful and stressful. Thus, the results in this study are based on the cadets’ subjective ratings and experiences.

Results and Discussion

The results show that the cadets spend on average 8.12 hours per week in front of the computer (std: 7.26, min: 1, max: 30). They spend, on average, 3.90 hours per week on gaming, i.e. playing PC-games and consol-games, (std. max: 30). They spend, on average, 3.90 hours per week on communication, approach march, enemy contact and their overall performance in both exercises. Many participants also mentioned that it was difficult to handle the handheld devices for the different platforms (i.e. gamepads, keyboard and mouse) in a good way due to inexperience.

Orientation and interaction difficulties. Many participants stated that it was difficult to orientate and to keep track of their combat pair partner in the game based environment. They thought it was much easier to work together and co-ordinate fire and movement in the live fire exercise. Many participants also mentioned that it was difficult to move around in the game based simulation. However, the cadets represent a homogenous group that is fairly basic and suitable for their educational level. Several cadets mentioned that the GBS was difficult due to limited gaming experience.

In the study the participants rated their own overall performance both in the GBS and in the live fire exercise. The results show that the participants feel they performed better in the field exercise than in the GBS. Their average rating was 5.61 in the field (std: 0.81) and 4.78 in the game based simulation (std: 1.23). Mean comparison revealed that the difference was significant, (t(47)=3.48, p<0.05. Some cadets stated that the live fire exercise was fairly basic and suitable for their educational level. Several cadets stated that the GBS was difficult due to limited gaming experience.

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There are a number of ways to overcome the interaction difficulties in the GBS. Part of the problem would probably disappear just by letting the participants practice more. Further more; in this study four different platforms were used, i.e. the participants had to learn how to use four different interaction devices that had basically the same hardware structure but different kepads with different functions. Thus, if one platform is being used instead of four, the time spent on practice can probably be reduced.

The problems relating to orientation and keeping track of the combat pair partner is probably more dependent on your choice of game than of how much time you spend on practice. The game Ghost Recon is a FPS-game where the player has a pretty limited field of vision, i.e. the player has practically no peripheral vision. Therefore it is very difficult to keep track of a team member or to discover an enemy. The field of vision is different in different games so you can minimise this problem by choosing another game. However, even if you choose a different game, one important orientation related problem still remains. When you “look around” in the simulated world it is easy to loose orientation because the participant does not move. Movement in the game is controlled with a gamepad, by means of a game compass. This is a well known, classical problem, which has been studied by several research labs (MOVES; ICT and FOI).

Results also show that the amount of hours the participants spend in front of the computer correlates positively with their performance in the GBS: .293*, i.e. the more time the participant spend in front of the computer the better he/she performs. The time they spend on gaming also correlates positively with how they perform in the GBS: .398**, i.e. the more they play games the better they perform.

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**Correlation is significant at the 0.01 level (2-tailed).

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3 In all ratings a scale from 1 to 7 was used, where 1 was the lowest rating (very bad, totally different, not at all educative ect.) and 7 was the highest rating (very well, exactly the same, very educative ect.).
**Task performance.** In the exercises the participants had a number of training objectives, i.e. they were to practise communication, approach march and enemy contact. Results show that the cadets rated their task performance higher in the field than in the game based simulation, see table 1.

<table>
<thead>
<tr>
<th>Field</th>
<th>GBS</th>
</tr>
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<tbody>
<tr>
<td>Communication</td>
<td>5.64</td>
</tr>
<tr>
<td></td>
<td>5.32</td>
</tr>
<tr>
<td></td>
<td>5.48</td>
</tr>
<tr>
<td>Approach March</td>
<td>5.7</td>
</tr>
<tr>
<td></td>
<td>4.52</td>
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<tr>
<td></td>
<td>5.11</td>
</tr>
<tr>
<td>Enemy Contact</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>5.00</td>
</tr>
<tr>
<td></td>
<td>5.61</td>
</tr>
<tr>
<td></td>
<td>4.78</td>
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</tbody>
</table>

Task performance was analysed by an ANOVA 2x3 within-participant design. The main effect of the exercise environment, i.e. field vs. GBS, revealed that the difference was significant $F(1.98)=19.18$, $p<0.05$, $MSe=0.61$, thus the participants rated their performance higher in the field than in the GBS. The second main effect, i.e. type of task, $F(2.98)=10.44$, $p<0.05$, $MSe=0.61$, revealed that the different tasks were rated differently. Pair-wise comparisons show that the difference between approach march and communication is significant, mean difference=.370, $p<0.05$, and the difference between approach march and enemy contact is significant, mean difference=.480, $p<0.05$. In other words, the cadets believed they performed best with their communication and had more difficulties with their approach march and enemy contact. The interaction effect revealed, $F(2.98)=9.16$, $p<0.05$, $MSe=0.56$, that the cadets rated approach march and enemy contact lower, and communication higher, in the GBS.

One possible explanation of the lower rating in the GBS is the above discussed lack of experience and interaction difficulties. The lower rating was evident on approach march and enemy contact, not on communication. This is not very strange since communication is not effected by gaming experience in the same way as the other two tasks, i.e. even though a participant have difficulties related to the interaction he/she can still be good at giving orders and communicating with his/her combat pair partner. Another possible explanation is that the participants not only judged their task performance in the GBS on how well they handled the training objectives but also took into account if they played well, i.e. if they “won the game”, which was irrelevant and difficult to achieve within the given time limit. This “winning condition” is in the nature of games and something that you normally do not find in traditional simulation platforms.

Many cadets stated that it was difficult to handle enemy contact both in the field exercise and in the GBS. In the field they found it difficult to use hand grenades and to give correct target indication. In the GBS the cadets found it difficult to discover the enemy and judge its location and distance. They also found it difficult to coordinate their fire since they did not always know exactly where their combat pair partner was.

### Similarity

In the questionnaire the participants also answered questions regarding similarity, i.e. the participants were asked whether or not they handled the tasks in the same way during the field exercise and the game based simulation. The results show that the participants do not think they carried out their tasks in the same way during both exercises, see table 2.

<table>
<thead>
<tr>
<th>Field</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>3.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Approach March</td>
<td>4.69</td>
<td>1.44</td>
</tr>
<tr>
<td>Enemy Contact</td>
<td>3.98</td>
<td>1.6</td>
</tr>
</tbody>
</table>

The results also show that the participants think that the approach march was most similar during both exercises whereas the communication was least similar. Paired sample t-tests show that the differences were significant, $t(51)=3.55$, $p<0.05$, $t(49)=2.64$, $p<0.05$, respectively. What makes these results interesting is the fact that the participants rated their communication performance highest (see table 1) but communication similarity lowest, i.e. they thought they communicated well during both exercises but they did not communicate in the same way during the field exercise and the GBS. One important question that needs to be raised is if the cadets really practice the same communication skills in the field exercise and in the GBS? Many participants stated that they found it difficult not being able to use hand signals and visual signals in the GBS in the same way as in the field, thus they could not communicate in the same way during both exercises. On the other hand, many participants thought it was good to be able to practice target designation and giving orders in a calm environment, thus they found both exercises useful even though they could not communicate in exactly the same way. The instructors that were present during the GBS

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6 the comparisons are tested under the LSD criterion criterion

7 According to the scale used for this question 7 represented “exactly the same” and 1 represented “not at all” so if the rating ? 7 the participants did not handle the tasks in the same way during both exercises.
noticed that the cadets’ communication skills got better and better over time which indicates that the GBS gave some kind of training effect. However, it is still important to investigate what kind of communication skills the cadets actually practise in the GBS and if those skills can be applied in the field.

**Educational effect**

The cadets also rated to what extent they found the exercises educative. The results show that the participants believe that the field exercise was more educative than the GBS, mean value 5.64 (std: 1.24) vs. mean value 3.69 (std: 1.43). Paired sample t-test shows that the difference was significant, \( t(54)=8.69, p<0.05 \). One possible explanation for this result is that the primary purpose of the GBS was not to be educative and the participants did not get as much guidance and feedback as they got in the field exercise. Some cadets stated that the purpose of the GBS was not clear and therefore they did not find the exercise very educative. Some cadets also criticised the game and stated that the exercise might have been more educative if a different game had been used. This is something we are aware of and agree with.

Another possible explanation concerns the participants own ratings on their performance. Since they rated their performance lower in the GBS than in the field they might have found it less educative. To investigate whether or not this is true correlation tests were conducted. The results show that the participants ratings of how educative the GBS was does in fact correlate with how they assessed their own performance: \( r=0.60**, \) thus, the participants that felt that they did not perform very well in the GBS (possibly due to inexperience) did not find the exercise very educative.

Many participants stated that field exercises, in general, are invaluable because during field exercises they get to practice in the right environment, with the right equipment. Some cadets stated that “learning by doing” is the best way of learning and therefore field exercises are better than GBS'. The cadets do, of course, have a point. We do not propose that a GBS is better than a field exercise and we do not propose that the GBS should replace field exercises. What we do want to investigate is if it is good to combine GBS' and field exercises. Maybe it is good to practice some exercises in a GBS and then go out into the field, i.e. to use the GBS as a way of preparing the cadets for the field exercise so they learn as much as possible.

The cadets’ attitude towards the GBS’ was not all negative; they did find them educational for some tasks. They stated that they believe that a GBS is a good environment to practice tactics, cooperation, decision making and giving orders.

**Combining exercises.** So, is it good to combine field exercises and game based simulations? Results show that the participants think that it is good to combine field exercises with GBS\(^8\), mean value 4.47 (std: 1.75). One-sample t-test shows that the result was significant, \( t(54)=10.70, p<0.05 \). Even though the average rating is just slightly higher than four, the result should still be considered to be positive. Since the GBS was not designed to give a training effect or to be educative it is reasonable to assume that the participants would have been even more positive if they would have gotten more guidance and feedback - there are in fact results that support this assumption.

**The instructor is important.** During the GBS we observed that the participating instructors gave a different amount of feedback to the cadets, i.e. one instructor gave considerably more guidance and feedback than the other two instructors. To investigate whether or not the amount of guidance and feedback influence the participants’ attitude towards the idea of combining field exercises and simulations, mean values between the different instructor groups were compared. The results show that the group that got a lot of feedback (eight cadets) think that the game based simulation was more educative than the rest of the cadets, mean value 4.25 (std: 1.49) vs. mean value 3.59 (std: 1.42). Further more, they were more positive towards the idea of combining field exercises and GBS, mean value 5.63 (std: 0.52) vs. mean value 4.28 (std: 1.83). The ANOVA revealed that the difference between the participants’ attitude towards combining exercises was significant, \( F(1.52)=4.17, p<0.05, \) \( \text{MSE}=2.95 \). The difference in rating on how educative the exercise was was not significant.

**Conclusions**

Even though the study had limitations relating to the game at hand, the interaction problems that occurred and the limited amount of feed-back the cadets received, a number of valuable lessons have been learned regarding the use of FPS-games in training of Swedish army cadets.

**Firstly,** although no modifications were made in the game, the study was successful and appreciated by the cadets and instructors. Considerable improvements could have been gained if the game would have had an open- or semi open source code making it possible to develop extra or own functions. Done correctly an inexpensive pedagogical and statistical tool could be obtained that can be used for training and education.

**Secondly,** the instructor’s role, and attitude, is important because it affects the GBS and the participants. The instructor must plan the GBS as any other military exercise

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\(^8\) According to the scale used for this question 4 represents “not good nor bad”, thus a value higher than 4 can be considered to be more good than bad.
so that it is considered to be more than just a game despite the game based interface.

Thirdly, the GBS is a good compliment to field exercises. The GBS offers a good environment for combat pairs to practise basic skills like communication and giving orders. However, it ought to be even more interesting to use the GBS for squad leadership training.

**Future work**

In the GBS it is easy to create complex, dynamic situations where the squad leader can practice various skills. Squad leader training is highly relevant for Swedish units participating in, for example peace keeping operations in urban environments. Therefore, it would be interesting to use Full Spectrum Warrior as a game based training tool for leadership training of squad leaders, a study that could be designed as a comparative study involving Swedish- and U. S. Army cadets, - ending in a paper presentable at SAMWAS 06.

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