



Immersive Business Simulation Games: an Innovative Pedagogical Approach to e-Learning and Education

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Serious games have been demonstrated to provoke active learners' involvement through exploration, experimentation, competition and co-operation. As a part of serious games, business simulation games are considered as effective tools for the empowerment and mediation of business content learning. They act as serious games which contribute to learning through a simulation of real-life situations and business environments. The blending of designed simulation technology and content curricula offers participants (players, students) a risk-free opportunity to test out a range of relevant strategies to drive business results. By customizing computer-based business simulations, participants can integrate key strategic and financial priorities. This paper provides a brief review of business simulations that serve learning purposes. The first part presents a short introduction and description of business games and their evaluation properties, and the second part provides a brief evaluation and analysis of selected business simulation games.

Keywords: Serious Games, Business Simulation Games, E-Learning, Problem-Based Learning, Education

Introduction

Computers are changing our world: how we work, how we shop, how we entertain ourselves, how we communicate, how we care for our health and the list goes on and on. Shaffer et al. (2005) are arguing will computers change the way we learn? Their answer is yes. Digital games have the potential to change the landscape of education as we know it. From early isolated reports on conferences and books reflecting about possible application of digital games for learning, more and more practitioners and researchers embraced the idea, including the e-learning community (Pivec, 2007). Each year more and different e-learning training products (training courses, training platforms etc.) are developed but most of these products do not exploit the full potential of ICT as contents and methodologies are still the result of adapting the traditional approaches of education and training to the new digital context (Pauschenwein, Goldgruber & Sfiri, 2013). Game-based learning environments (also described as serious games) are gaining wide acceptance in many domains due to a number of contributing educational factors. Over the last 10 years an emerging trend of digital serious games appears integrated in the area of e-learning. Digital serious games have been demonstrated to provoke active learner's involvement through exploration, experimentation, competition and co-operation. They have been seen as good opportunity for supporting learning because of their capability to increase visualizations and challenge the student's creativity (Riedel & Huage, 2011). Serious games have the potential to significantly improve training and education activities and initiatives. The search for new positioning of serious games within university programmes is still an issue of discussion as the changing setting of education by use of gaming is becoming slowly a new form of interactive content, worthy of exploration.

In traditional learning, students often meet with studying literature in form of PDFs, PowerPoint presentations or any other kind of digital media sources. Using the knowledge that has been provided in classrooms and at lectures, real situations can be practiced and simulated mainly by training within the gaming environment. The digital games and simulated real-life process allow learners/students to use their newly acquired skills and knowledge by applying them to a competitive challenge offered within these multimedia tools. There are specific training domains where serious games, learning concepts and approaches have shown a high learning value. Various authors anticipate the great opportunities of games (and simulations) in education, because of their positive effects on learning outcomes e.g. (Hogarth, 2001; Berry, 2007; Bernard, 2006). Serious computer games are part of the new emerging education environment that is based on sophisticated technology with elements of entertainment. Michael and Chen (2006) give the following definition: 'A serious game is a game in which education (in its various forms) is the primary goal, rather than entertainment'.

It is worth mentioning that Corti (2006) has stated that game-based learning/serious games are all about leveraging the power of computer games to captivate and engage end-users for a specific purpose, such as to develop new knowledge and skills.

As a part of digital serious games, business simulation games (Rollings & Adams, 2003), or economic simulation games, are serious games that focus on the management of economic processes (Rollings & Adams, 2006), usually in the form of a business. They can bring the effective methods of learning and experience through business challenges that students usually need to meet before setting foot in the real world. They help students to grasp key business and management concepts and make effective business decisions by using a combination of visual, auditory and hands-on approaches (Duggan, 2013). Because they simulate the real-world system, they can often be used as a teaching method at university level, particularly in business schools, but also for executive education. The benefits of business simulations are in the possibilities to learners to experience and test themselves in situations before encountering them in real life and give them the chance to experiment and test hypotheses (Lean et al., 2006). Being a business simulation game, the participants can select different decisions without any fear for a real loss to the organization in case participants make mistakes. Business simulation games help to model the realities of the business world by simulating basic – and in some cases advanced – business theories and practices in controlled game environments (Farkas, 2007).

Hence, games are an effective tool for mediating learning. Computer games not only convey hard skills such as the understanding of how complex systems operate, production networks being one of them, but also mediate soft skills such as collaboration and communication (Scholz-Reiter et al., 2001). Some games are designed at a very high level intended to fulfil the learning methods, while some games are very poor and do not meet expectations regarding the learning purposes. This paper provides a brief review of the usage of serious simulation games. It presents several types of games that are available and explains their properties in order to help bring educators/learners closer to the possibility of using business simulation games to support their educational aims, objectives and planned outcomes.

Definition and Selection of the Required Game Parameters and Business Simulation Games

The term business simulation game covers a wide range of activities, anything from a card based face to face activity to an interactive online one. It is used to refer to business focused activities designed to develop business acumen and management focused activities designed to improve the way in which an organization is managed. Elgood (2011) define a business simulation games as a device through which individuals learn about how businesses and organizations work, and which enables them to improve their performance within their organization through the development of business and/or inter-personal skills.

It is important that business simulation games are: realistic, engaging and motivating (Trybus, 2013). Good business simulation games (applications) can draw us into virtual environments that look and feel familiar and relevant. According to Dr. Susan Ambrose, director of Carnegie Mellon's Eberly Center for Teaching Excellence, this is motivational because we can quickly see and understand the connection between the learning experience and our real-life work (Trybus, 2013). Within an effective learning environment, we work toward a goal, choosing actions and experiencing the consequences of those actions along the way. This keeps us highly engaged in practicing behaviors and thought processes that we can easily transfer from the simulated environment to real life (Trybus, 2013).

Business simulation games can be usually presented as a training technique in which participants consider sequence of problems and take decisions. The main component is simulation which is based on sequential

decision-making exercise structured around a hypothetical model of the operations of an organization. It is important that they help to model the realities of the business world by simulating basic – and in some cases advanced – business theories and practices in controlled game environments (Klabbers, 2009). They have been used as well as in experiments, such as those done by Donald Broadbent who has studied learning and cognition. Those studies have revealed how people often have an attitude for mastering (Hogarth, 2001). Participants can select actions and can have experience regarding the consequences of those actions. The learners/students are using their newly acquired skills and knowledge by applying them to a competitive challenge provided within the business game. The games are essentially numeric, but they usually try to hold the player's attention by using creative graphics. The interest in these games lies in the accurate simulation of real-world events using algorithms, as well as the close assessment the player's actions to expected or plausible consequences and outcomes. An important face of the economic simulations in games is the emergence of artificial systems, gameplay and structures (Remondino & Bussolin, 2011).

However business simulation games come in different shapes, types and sizes. By browsing the vast “ocean” of the business games in computer technology environment, it is become difficult task to find the game that would fit to support all possible business aspects and learning outcomes. In general they can be either too time consuming, too complex for classrooms or too engaging so that any intended educational focus (by educators) appears to be hard to construct (Royle, 2011). For the purposes of this paper, the business simulation games had to be classified according to adequate properties. The first taxonomies and classifications of business simulations were already introduced and presented by Greenlaw et al. (1962). However, according to Biggs (1990), the same taxonomy was used while he attempted to classify the computerized business management simulations. While establishing the background and the nature of the business management simulation, Biggs (1990) states there is no single way to define the classification of business games. Business games can be classified on a number of dimensions. The next attempt to classify business games used in distance education courses was presented by Pillutla (2003). Unfortunately, his classification of business games was merely according to “how they are distributed”, which leads to our conclusion that the “web-based” business games do not gather the whole spectrum of business simulation games. For the survey of “web-based” and “non-web-based” business games, Biggs' classification is going to be used.

The evaluation properties have been classified into the two major groups. The first group – **the technical classification** – presents the properties using the technical data that describe the business simulation game and the second group – **the usability classification** – presents the variety of dimensions that describes types of usability characteristics. All properties are described in the following sections and have been used in the Table 1.

Technical Properties

As described above the business games can be classified on the following dimensions:

- Web-Based/Desktop: Whether the game can be played via modern browser or with installation package
- Distribution: Whether the game is free for use, played by license, on CD-ROM, or run by downloaded application/client
- Year of publishing: The year that game was started to be available for public use
- Users: How many registered users the game has (up to 2010)
- Label: The name of the development team
- Single/Multi user: Whether game can be played by one or many players
- Dimension: Whether game is present in 2D/3D environment

Usability Properties

- The time period simulated: E.G. day/week/quarter/year
- Industry specific or generic: In industry specific game, the authors attempt to replicate closely the actual industry. In generic games only general business relationships are replicated
- Degree of complexity: Game decision input variable complexity, or the computer model complexity
- Functional or Total enterprise: Designed to focus specifically on problems of decision-making as seen in one functional area or designed to give participants experience in making decisions at a top executive level and in which decisions from one functional area interact with those made in other areas of a firm
- Competitive or Non-Competitive: Whether the decisions or participants influence the other participants or not

- Feedback system: Whether the results are shown by gained scores, experience points, upgrade level or a summary reports
- Deterministic or stochastic: The stochastic alternative is probabilistic, including chance of elements
- Briefing systems: The level and usability of briefing screen
- Learning objectives: Types of learning skills that can be obtained. E.G. business strategy/ strategic management, finance.
- Background knowledge: Whether a basic/advanced or none business knowledge is recommended in order to play a game
- Interactivity type: In an interactive game participants respond to the questions at the computer, receive an immediate response, and then submit additional decisions. In a non-interactive game decisions are submitted to the game administrator.

Selection of Business Simulation Games

When selecting business games for evaluation, an internet search was conducted, and we were confronted with the countless computerized games that are described as a business games. The World Wide Web provided us with countless lists of business games. The Wikipedia lists hundreds of business games that are listed in alphabetical and chronological order. However, most of the games listed are considered to be more entertainment than edutainment, which takes us out of our focus of selection (so called “tycoon” games that cover different business areas – Zoo Tycoon, Rollercoaster, Hotel Tycoon, can be potentially used as a learning tool or for education purposes, but they are more unlikely to be classified as serious games, because they mainly originate from the entertainment industry, and are classified as commercial games).

The second attempt of selection of the business simulation games was made by reviewing business-game-related articles. Riedel and Hauge(2011) have listed 39 serious games that covered topics such as finance, management, product management, industry management, leadership, etc. The list of games has been conducted in 1998 as part of the COSIGA project (www.biba.uni-bremen.de/projects/cosiga/). Since the project is outdated, the list was updated by games that have been developed by GALA project partners (www.galano.eu). Another and final updated list of the games was done by the authors, who have personal experience with the games that have additionally been selected.

All together, 30 business simulation games have been tested. Nine of them have shown the highest presence of realistic, engaging and motivating elements (Trybus, 2013) while playing them (for example: attractive graphic environment, real-case scenarios, virtual money, etc). Furthermore, they have been analyzed and evaluated with *usability* and *technical* properties. The following business simulation games have been selected:

INNOV8

The INNOV8, also known as the IBM Business Process Management (BPM) simulation game is a role-playing game that simulates business process management in a 3D environment. The IBM SOA (Self-oriented architecture) team originally created the game to help educate potential SOA clients. The initial version was only open to the academic community and has been in use at over a 1,000 universities and colleges (as far and wide as Beijing and Manchester) since its launch in 2007. The game gives the user a chance to experience and learn about BPM and understand how information and decisions are processed in the business world. The following picture (Figure 1) presents the main virtual character Megan guided by a player.



Figure 1: INNOV8 game (a screenshot of virtual character named Logan)

Virtonomics

Virtonomics is a business-strategy oriented on-line game played as an MMOG (massive multiplayer online game) where the basics of management are tested. It is designed for fans of economic and strategic games, and to study the basics of management. The game itself requires an understanding of laws of real life economy, business and finance, yet players do not need a deeper understanding of economics or any special background education to take part. The game is helpful in meeting interesting people with common interests and making useful connections.

Shark World: A project management game

Shark World is an excellent addition to the basic project management training. It is design to experiment and gain experience with key aspects of project management in a highly entertaining and motivating setting. This on-line game creates a convincing virtual environment in which a project is developed in real time, urging the students of to interfere when things go wrong, or preferably, before they do. The game is played via both the online and mobile channels. Projects develop in (accelerated) real-time (24/7) so players have to keep up with a fast pace and act and intervene immediately. The following picture (Figure 2) presents the GUI (graphic user interface) in the Shark World game.



Figure 2: Shark World (a screenshot of Graphic User's Interface)

eRepublik

eRepublik (www.erepublik.com) is a massive multiplayer online strategic game developed by Republik labs. It is free of use and combines social networking elements (Facebook, LinkedIn, etc.). The game is set in a mirror world called the New World. The players take a role of citizens where they can participate in daily activities. The gameplay is based on a war-time situation which takes a potentially crucial role by increasing the economic or political power of a country. A nation that has experienced and battle-hardened citizens can become a global power and grow global economy business.

Virtual Leader

Virtual Leader is a simulation training game which is focused to develop leadership skills and aspects through various scenarios in a "virtual world". It is a role-playing 3D game with "sim-like" graphical environment. Virtual Leader provides a nice and friendly e-learning platform in a form of "role-play-game" that allows users to develop necessary skills, that are relevant and needed in business environment. The following picture (Figure 3) presents the virtual meeting session in progress, where a player interacts with virtual characters.



Figure 3: Virtual Leader (A screenshot of business meeting at Virtual Leader simulation)

Wall Street Survival

Wall Street Survivor (www.wallstreetsurvivor.com) is a web-based financial (stock market) game with real market data, real stock symbols, and real market tracking, all accounted for on an impressively simulated trading platform. It simulates real-time bid/ask trade fills, as well as streaming profit and loss pages. In order to play the game, a profile account needs to be created and registered. Once a user is registered at Wall Street Survivor, he/she receives an account with \$100,000.00 in simulated money to trade with.

The Beer Game

The Beer distribution game, also known as The Beer Game is a role-play supply-chain simulation game that lets students experience typical coordination problems of supply chains without information sharing and collaboration. The purpose of the game is to understand the distribution side dynamics of the multi-echelon supply chain used to distribute a single item, in this case cases of beer. The aim is to meet customer demand for barrels of beer through the distribution side of a multi-stage supply chain with minimal expenditure on back orders and inventory.

Big Oil: Build an Oil Empire

Big Oil: Build an Oil Empire is a business strategy game where users take a role of an oil baron set in times of the oil industry pioneers. They aim to build their own oil empire by taking control of the entire oil business process, from surveying, drilling, and extracting to refining, selling, and market investments. Big Oil lets users build an oil empire by drilling for oil, shipping it to refineries around the world, and eventually processing it into products that can be sold to the public. To play the game user/player can choose from more than 15 scenarios based on historical events such as the Oil Crisis, Lenin's death, Apartheid, etc.

Business Tycoon Online

Business Tycoon Online (bto.dovogame.com) is innovative well known massively multiplayer online game that originated in Asia. The game supports thousands of players simultaneously. It is designed as a business simulator where players must rise to the top of the social ladder as industrial tycoons. Players take the role of an entrepreneur in a virtual business world where they start their own business to break through constant challenges to eventually end with building up a universal corporation or a powerful business empire.

Analysis and assessment of selected business games

Below we present the evaluation parameters and results for the selected games.

Table 1: Evaluation parameters and results.

	eRepublik	Virtonimics	Shark World	IBM innov8	Virtual Leader	Big Oil	Wall Street	The Beer Game	Business Tycoon Online
Web-Based/desktop	Web-based	Web-based	Web-based	Desktop	Desktop	Desktop	Web-based	Web-based	Web-based
Distribution	Republik Labs	Virtonomics team	RANJ	IBM	SimuLearn	Try Sinergy	Wall Street Survivor	MTI Sloan	Dovogame
No. of users	**400.000	**550.000	n/a	n/a	n/a	n/a	350.000	n/a	**600.000
Year of publishing	2008	2009	2008	2009	2003	2006	n/a	n/a	2010
Dimension	2D	2D	2D	3D	2D	3D	2D	2D	2D
Platform	Any	Any	Any	PC-Windows	PC-windows	PC-Windows	Any	Any	Any
Free of use	Yes	Yes	Purchase required	Registration approved	Purchase required	Purchase required	Yes	Yes	Yes
Time period	Min. 1 month	Min. 1,5 month	Min. 1 month	2 to 4 hours	6 to 9 hours	8-10 hours	Min. 1 month	1 to 1,5 hours	Min. 1 month
Industry or generic	Generic	Generic	Industrial	Industrial	Industrial	Industrial	Generic	Industrial	Industrial
Degree of complexity	Low	Medium	Medium	Low	Medium	Low	Low	Low	Medium
Functional or enterprise	Enterprise	Total enterprise	Total enterprise	Enterprise	Enterprise	Functional	Functional	Functional	Total enterprise
Competitive or non-competitive	Competitive	Competitive	Non-competitive	Non-competitive	Non-competitive	Competitive	Competitive	Competitive	Competitive
Feedback system	Experience points	Virtual money income	Customer influence	Points received	Statistic charts	Points received	Virtual money	Statistic charts	Points received
Deterministic or stochastic	Deterministic	Deterministic	Deterministic	Deterministic	Deterministic	Deterministic	Stochastic	Deterministic	Stochastic
Briefing systems	Tutorial video of personal mentor	Poorly supports with mail from virtual administrator	Supported with mails from virtual administrator	The virtual note support	Text instructions and audio/video tutorial	Virtual assistant provided	Text tutorial	Text tutorial	Text tutorial
Learning objectives	Strategy skills, politic-management skills	Strategy skills, politics-management skills	Project management skills, hard skills, soft skills	Business process management skills	Leadership skills	Business strategy skills	Financial skills, stockbroker skills	Coordination, logistic skills	Strategy business – decision making skills
Background knowledge	Not required	Required	Required	Required	Not required	Not required	Required	Not required	Not required
Interactivity type	Yes	Yes	Yes	No	No	No	No	No	No

The legend: ** = the information has been last updated in 2010

Analysis of the result

The place of business simulation games in business education depends on the purpose of their usage and achieved goals. Therefore, business simulation games can be allocated to different types or categories, based on the variety of “learning” content that can be “digested” in order to extract the learning activities. While selecting the most adequate business simulation game, it is important to know that the game scenario must meet the educators or learners expectations. At this point it is important to note that such games must have highly developed segments or levels of reality. The better the imitation of reality in a game is, the more phenomena and the higher level of relations complexity between them are encompassed by the game scenario. Such games enable faster transfer of the experiences of participants directly to their learning target. In our case, Shark World: A project management game was demonstrated as a very good example. Besides the user-friendly GUI (graphic user interface), the game provide us with excellent underlying storyline (which turn as a very entertaining), using fictional characters (played by the real actors) and video material, which give us a nice attempt to feel like to be part of a real business project. Overall, the game brings the right amount of combining entertainment material with educational content. Meanwhile, The IBM’s INNOV8 also played a good part in engaging player into the virtual environment. The game consists of rich graphics, cut scenes, scenarios and interesting walkthrough. It gives a good opportunity to explore how to learn about business process management and to collaborate with virtual characters to map out business processes, identify process bottlenecks and explore what-if scenarios. According to the study carried out by Ewing Kauffman Foundation (www.kauffman.org), the game proves to be effective way to engage students by teaching them leadership, project management, innovation and entrepreneurship skills. On contrary, the Beer game gives the impression of a very poor level of user satisfaction. While, the game itself brings a good example of realistic simulation of supply chain and the bullwhip effect which is a well-known phenomenon and a prominent symptom of coordination problems in supply chains, the game shows very poor graphics. The game consists of poor GUI (graphic users interface) and few graphical objects: beer barrels, a transport truck, a factory image and beer storage. Functionally, there is nothing much to do. With no sufficiently presented scenario, players are more likely to be confronted with a subsequent extreme dullness. The similarity of “poor functionality” is Virtual Leader. The gameplay focuses only on choosing the right set of dialogues with virtual characters. Yet, the game provides excellent background materials that bring players up to speed to their involvement and to quickly engage in to the game. On contrary, MMOG business games (Virtonomics, eRepublik, Business Tycoon On-Line), challenge players to get to know the whole functionality of their game-menu and GUIs tool bars without any “quick-to-learn” tutorial support. In general the selected games can be helpful if they demonstrate some aspects of strategy business, decision making processes business management and organization activities that helps in changing the player attitudes and improve better performance.

Evaluation and discussion

Business simulation games use different scenarios and virtual worlds that support player motivation in order to reach the learning goals. They specially try to make a good attempt to capture and combine virtual reality technologies and engaging components of video games in the simulations offered within serious games. Bringing the massive size, resources and technology of video games industry, modern business games are now bringing learners in to an environment where business (management) processes can have a major role. Unfortunately, to this good property many games involve only quantitative variables while ignoring human elements of organization. In order for simulation games to meet the requirements for didactic tools and learning methods, they need to be extremely precise in imitating market realities. The use of an obsolete (outdated) model can lead to a permanently negative opinion of the game participant about this form of education.

In our case, eRepublik turns to be very limited regarding player expectations. On eRepublik related forums, many users have posted complaining comments, for example: not many realistic actions occur in the game (wars are the only factor driving the economy, running companies turns to be too easy, the source and amount of information is limited, etc.) (Khenke, 2011). On the other hand, SimuLearns’ Virtual Leader shows us an excellent case how to simulate human behavior in order to practice the tenets of three-to-one leadership with imitations of business meeting sessions which can be mirrored into the real-life situations. Beside the attractive virtual reality, simulation games can keep learners motivated also with monetary rewards. In this case, Wall Street Survivor is not just a mere stock simulator, it provides a competition by giving some attractive real money prizes to the top players in order to keep them motivated. Overall, the games that were selected for our evaluation, demonstrated that it can be helpful if they represent the aspects of business strategy, decision-making processes, business management and organizational activities that helps to change player attitudes and improve performance. They provide user experience in the application of statistical and analytical methods that are used as economic tools.

Evaluation that demonstrates how effective business simulations are and how the measurement of the learning-outcome can be done, still remains a research topic to be explored by education experts and researchers. What we must point out is that many educators may have limited expectations and are threatened by the vast number of available business games. It is also worth noticing that the game-based learning culture is still emerging as many educators are seeing the games as tool that undercuts traditional educational values, promoting anti-social or solitary behavior (Keys & Wolfe, 1990). Table 1 gives the quick review of the usage of serious simulation games in order to bring educators and learners closer to the business simulation games selection for learning and teaching purposes.

Conclusion

The pedagogical barriers to the adoption of serious games as a tool for learning are, perhaps most profound. In short, there is not enough evidence that demonstrates the effectiveness of digital games within an education context. Many still question the transferability of learning – when we play a digital game, particularly one that is ostensibly “educational”.

Business simulation games based on the use of the computer and internet capabilities are a reality and they are expected to be the default tool in many areas in the future. Due to their limitations or functionalities many of them will be adapted or re-modeled (Bernard, 2006). Depending on the discipline, an environment can have real character, that is, it exists in reality or a virtual character, and that is, it comes into being through simulation of real phenomena. It can be claimed that business simulation games are perceived as an interesting and desired form of gaining experience that can be used in later professional practice (Wawer et al., 2010).

Business simulation games can be absorbing, provoking and motivated, when participants are being engaged with effective learning (Riedel & Hauge, 2011). It must be noted that playing and testing games selected from the current state of “business games” is not fully sufficient to present the whole knowledge area represented by business education, yet they address the changing competences needed in the information age: self-regulation, information skills, network cooperation, problem-solving strategies, critical thinking, and most important - creativity. But, unfortunately, they can also be too time consuming, too complex for classrooms or too engaging so that any intended educational focus (by educators) appears to be hard to construct (Royle, 2011). Yet different limitations appear, that may or may not support the envisaged educational aims, the educator’s objectives and planned outcomes. Some games have a very high level of complexity intended to fulfil the learning methods and some games are very poor and do not meet the requirements that are expected to foreground the learning purpose. Generally, it is not possible to implement all necessary learning conditions that cover all areas of knowledge. Yet, different games can provide different skills and practice. By defining types of learning outcomes that need to be fulfilled and what fields of business education need to be “trained”, the combination of most appropriate games can be created in the sufficiently large and rich set of business games (Royle, 2011). All in all, business simulation games are one of the most important methods of acquiring technical and problem-related knowledge.

Overall, the potential of business simulation games as learning tools will increase given the improving underlying technology, availability of kit, increasing interaction techniques, software’s ability to process data, and the increase in gamers (McClarty et al., 2012). When adequately set up, they are a practical teaching-related arrangement that combine the natural predisposition of the players/learners with planned and directed knowledge acquisition. With most other teaching methods, this is rarely the case. At this point, business simulation games should be used as a didactic method whenever conditions meet the learning goals and outcomes.

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