An Exploratory Taxonomy of Business Games

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Abstract

This article proposes a business game taxonomy. In doing so the taxonomy creates a comprehensive definition of business games in general and identifies their parameter-defining characteristics. A successful taxonomy can facilitate the comparison of different game-based educational tools while also directing application-based research to a game’s most learning-associated components. The field’s existing taxonomies within the literature are inadequate for both purposes. The genesis of our five-part taxonomy was both literature-based and intuitive. It is hoped this taxonomic effort serves to realize a global database to be filled in collaboratively by the community of game users and developers.

Keywords: business game, game-based learning, management game, simulation, taxonomy

Business games (BGs) are serious games very popular in management education. Almost every MBA AACSB programme requires students to play one or more management simulations, and BGs usage is even higher at the undergraduate level (Faria, 1998). Many companies and universities are following this example. Public administrations ask developers for customized business games (Keys, Fulmer, & Stumpf, 1994; Hubble, Richards, & Wilfong, 2011). Surprisingly, BGs are not new to the gaming industry. In 1956, the first widely known business game, Top Management Decision Simulation, was developed by the American Management Association (AMA) (Meier, Newell, & Pazer, 1969).
Over the years, detailed BGs developed by academics or specialized private developers faced the competition of challenging “amusement” games about business or management which were most of the times developed without any ambition of teaching business skills or properly simulating a real competitive environment (e.g. OIL BARONS or SID MEIER’S RAILROAD TYCOON). Such market fragmentation has generated confusion as to what kind of serious games can be called “business games”.

In the light of these considerations, the present article aims to do the following:

- to add clarity to the topic by providing a novel definition for the category,
- to define an in-depth taxonomy of BGs able to characterize the different games and to point out trends in the developer community,

Consequently, our research activities have been driven by the following questions:

\[ Q1: \text{How can we provide a definition that covers all BGs in the literature?} \]

\[ Q2: \text{What are the relevant characteristics of a BG? How can they be classified?} \]

This article begins with a brief analysis of business gaming, a historical background and an analysis of the various BG definitions. Next, we propose our own definition of BG. In addition, we present our five-part BG’s taxonomy. The elements in the taxonomy are explained in depth. Finally, we discuss the results and the limits of the research as well as provide some research directions.

**Historical background**

In 1955 the Rand Corporation released MONOPOLOGS, an organizational game in which players from the US Air Force had to perform as inventory managers in a simulation of the Air Force supply system. The first widely known business game (BG) was released one year later: the AMA’s TOP MANAGEMENT DECISION SIMULATION (1956). By 1961, it was estimated that more than 100 BGs existed and that more than 30,000 business executives had played at least one BG (Kibbee, Craft, & Nanus, 1961). In the decades that followed, BGs usage in universities and in
industry increased dramatically (Faria, 1987, 1998), keeping pace with technological and pedagogical innovations. Of more than 2300 serious games described in the “Serious games classification” database (http://serious.gameclassification.com), 7.2% belongs to the “enterprise” market segment, while several BGs may be found also in the “education”, in “advertising” and in “state and government” segments, which include more than 60% of the total.

Since their inception, the main purpose of BGs has been to teach. Indeed, Ricciardi et al. (1957) suggested that the BG is an element in a decision making course which they had hoped would lead to a sort of war college for business executives. Over the years, “the use of games and simulations in economics has become well established, with a well-developed body of literature to support their use in the teaching environment” (Sutcliffe, 2002, p. 2). In fact, BGs and business simulations have proven to be effective at improving business skills (Greco & Murgia, 2007; Rachman-Moore & Kennet, 2006), although many authors in the field recur to evaluation methodologies that lacks in scientific rigour - as discussed by Gosen & Washbush (2004) – and it is very difficult to demonstrate learning occurred through simulation (Anderson & Lawton, 2009).

Lane (1995, p. 607) explains how BGs combine both gaming and simulating in structured experiences, with purposes that can be recreational, educational or both. Moreover, “games and simulations can serve as mechanisms for releasing learning that seems to lie dormant in organizations” (Keys, Fulmer, & Stumpf, 1996, pp. 36-37).

The advantages of BGs relate to human integration: “Simulation games are one very efficient and practical tool to improve the human integration dimension. This means both integration among different people working in the same business process chain and integration between the human and the IT systems” (Savolainen, 1997, p. 221). In addition, role-playing in the business context can improve soft-skills such as decision-making, negotiation and communication (Chapman & Martin, 1995, p. 73). Larreche (1987, p. 562) explains how rapid feedback on players’ decisions, together with the motivation provided by the competitiveness of a BG, can improve the learning experience.
Finally, Kolb & Fry (1975) have suggested that games and simulations provide a learning-from-experience approach to managerial education. In fact, the authors presented a theoretical framework to illustrate it: Kolb’s four stage experiential learning cycle.

A definition for Business Game

As Maier & Größler (2000) noted, “management simulator” is often synonymous with “business simulator”. In fact, many of the definitions that have been offered in the literature use the word “management” as if synonymous with “business”. This might seem reasonable; nevertheless, games focused, for example, on the management of an airplane (e.g. MICROSOFT FLIGHT SIMULATOR X), a lawsuit (e.g. OBJECTION!), or on a negotiation with a terrorist (e.g. THE NEGOTIATOR), should not be considered BGs. In other words, we assume that equating the two is acceptable only when players virtually manage, for example, a commercial firm, a non-profit organization, a financial portfolio, a department, or a team working in the business area. While this list is not exhaustive, it helps us to show the broader meaning that we attribute to the word “business”. Traditionally a business organization is “an entity formed for the purpose of carrying on commercial enterprise” (Encyclopaedia Britannica), however the word “business” is increasingly used also with reference to non-commercial organizations such as non-profit and state-owned. Thus, in this article and to the aim of the definition of a “business game” we consider “business” as a synonym of “related to the management of organizations”. Therefore, we argue that management games are not (necessarily) BGs. Nonetheless, in many cases, the two sets do indeed overlap (see Figure 1): for example, in THE GLOBAL BUSINESS GAME players manage international businesses.

One more important distinction to make is the difference between a business game and a business case study. As remarked by Carson (Carson, 1969, p. 39), “Business games are case studies with feedback and a time dimension added”.
Even though some BGs do not provide a detailed feedback (such as an evaluation of the player’s performance), on the whole, such a definition seems fair, because almost all of them provide at least a score that can be the basis for generating goal-directed feedback. That said, we would also argue that case studies, for their part, do not provide an opportunity to interact with the environment, such as competitors or virtual markets.

Baldisson et al. (2007, p. 10) states: “Management games are all the simulations used to support managerial learning through an experience that features competition and rules in the socio-economic environment”. Such a definition raises an interesting point: what is a simulation game? What are the
differences between a business game and a business simulation game? According to Ruohomaki, (1995, pp. 13-14), simulation and simulation game can be distinguished as follows:

![A graphical representation of the set of Games and its subsets](image-url)
“A simulation is a working representation of reality; it may be an abstracted, simplified or accelerated model of a process. It purports to have a relevant behavioural similarity to the original system”.

"A simulation game combines the features of a game (competition, cooperation, rules, participants, roles) with those of a simulation (incorporation of critical features of reality). A game is a simulation game if its rules refer to an empirical model of reality”.

As the representation could be abstracted, simplified or accelerated, we argue that a low-fidelity game can be deemed a simulation when it refers to reality. The already cited MICROSOFT FLIGHT SIMULATOR X is of course a simulation as well as THE GLOBAL BUSINESS GAME, while the former is an airplane management game (i.e. a game that simulates the operation of an airplane), and the second is a “total enterprise game” (i.e. a game that simulates the management of an enterprise). Thus, each business game that incorporates any of the critical features of the “business world” should be considered a business simulation game. This is quite important because we are allowed to include in the category those games that, although not simulating a competitive market, refer to dynamics typical of business, such as human resources management, leadership, project management, and negotiation (which are associated with other types of competition).

Indeed, it seems that any business game could be considered a business simulation game; that is, BGs should be included in the “simulation game” category.

Eilon (1963) has affirmed that BGs have a three-fold purpose: they can be used as training tools (in which players must face the consequences of their decisions), they provide an overall view of corporate strategic functions and they can simulate market trends in order to improve a player’s capacity to face changes.

We argue that the focus of a BG’s definition should be the purpose of the game, not the methodological technique implemented therein. A generic game could have up to two “serious” aims: teaching business topics and or evaluating players’ performances.
Thus we conclude that a business game is a serious game in a business environment that can lead to one or both of the following results: the training of players in business skills (hard and/or soft) or the evaluation of players’ performances (quantitatively and/or qualitatively).

There is much debate about whether entertainment-oriented games that have been developed without any “serious” purpose can improve the business skills of the individual. In fact, in many amusement-driven games players are asked to make business choices that simulate the ongoing practices of a company or institution. In order to classify such games fairly, we must evaluate how the skills improved by playing such a game are then useful within everyday business settings. For example, is playing ZOO TYCOON of use to a real zoo manager? Can the management of a zoo be considered as doing business? According to the extended meaning of “business” that we introduced before, managing a zoo actually is doing business (even though non-profit). However, it is unlikely that a real zoo manager would use it to improve his skills or to train himself/herself before undertaking such job.

Since we cannot evaluate the players of these games, we regard as BGs only those games capable to train players directly in skills that can be useful within a business setting. For example, playing “DOOM” can increase a player’s reactivity and multitasking skills, which can also be useful in a business scenario. However, this is a collateral effect of a game in which the purpose is not tied to “being useful in a business scenario”. We call this effect “indirect training”. A game that provides indirect business training should not be considered within the domain of BGs.

Of course, we exclude, a priori, all BGs that offer erroneous teaching and virtual environments that manifest patently unrealistic reactions to a user’s choices.
A taxonomy of BGs

BGs were first classified by Eilon (1963) in terms of their design characteristics (total enterprise or functional, interacting or non-interacting, computer or non-computer) and according to their expected use: 1) as a part of a general management training program, 2) for selling new techniques or procedures or 3) for conducting research (e.g., on the behaviour of systems, on the decision-making processes of individuals, or on the interaction of individuals within a team).

In addition, we are indebted to Aarseth et al.'s (2003) classification of games (later refined by Elverdam & Aarseth, 2007)) and to Maier & Größler’s (2000) classification of computer simulations. It should be noted that in most cases, in order to simplify the analysis, these authors attempted to structure the elements of their taxonomies using binary forms.

<table>
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<tr>
<th>Taxonomy for Computer Simulations (Maier &amp; Größler, 2000)</th>
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<td>External Time**</td>
<td>1) Environment Of Application</td>
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<td>a) Degree Of Integration</td>
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<td>i) Mimetic</td>
<td>i) Stand-alone Simulation</td>
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<td>ii) Multi Person</td>
<td>ii) Arbitrary</td>
<td>ii) Integration in Learning Environment</td>
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<tr>
<td>b) Degree Of Integration</td>
<td>b) Teleology*</td>
<td></td>
</tr>
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<td>i) Stand Alone Simulation</td>
<td>i) Finite</td>
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<td>ii) Integration In Computer-Based Environment</td>
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<td></td>
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<td>c) Main Area Of Application</td>
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<td>i) Perspective*</td>
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<td>ii) Support By Teacher/Facilitator/Coach</td>
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<td>i) Discrete Periods</td>
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<td>ii) Simulation In One Run</td>
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<td>c) Advancing Of Time In User Interface</td>
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<tr>
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<td>n) Positioning**</td>
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<td>ii) Decision-Oriented</td>
<td>i) Location Based</td>
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<td></td>
<td>ii) Proximity Based</td>
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<td></td>
<td>iii) Both</td>
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<td></td>
<td>o) Haste</td>
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<td>2) Design Elements Of User Interface</td>
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<td>a) Chance Of Intervention While Simulating</td>
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<td>ii) Simulation In One Run</td>
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<td>iii) Continuous</td>
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<td></td>
<td>b) Sequential Nature Of Decisions</td>
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<td>i) Strict Sequentiality</td>
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<tr>
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<td>ii) Explorative</td>
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<td></td>
<td>c) Characteristics Of Users’ Decisions</td>
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<tr>
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<td>i) Qualitative</td>
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<td>ii) Quantitative</td>
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<td>d) Internal Time:</td>
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<td>i) Haste</td>
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<td></td>
<td>(2) Absent</td>
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</tbody>
</table>
### 3) Model

a) Real-World Domain
   i) Business
   ii) Other

b) Structure
   i) Feedback-Oriented
   ii) Process-Oriented (Mostly Without Feedback)

c) Behaviour
   i) Deterministic
   ii) Stochastic

d) Generality Of Model In Regard To Domain
   i) Special Area Of Interest
   ii) Whole Domain

e) Proceeding Of Time In Simulation Engine
   i) Discrete
   ii) Continuous

f) Role Of Simulation Model
   i) Active Generation Of Decisions
   ii) Clearing Device For Users’ Decisions

g) Influence Of External Data
   i) With Such Influences
   ii) Without Such Influences

h) Domain Of Variables
   i) Integers
   ii) Real Numbers

3) Target Groups, Goals Objective & Feedback

a) Target Groups, Goals Objective
   b) Goals Regarding Users
      i) Judgement
         (1) Users Are Going To Be Tested
         (2) Users Are Not Going To Be Tested
      ii) Change
         (1) In Attitude Towards A Specific Issue
         (a) Users Are Going To Be Motivated
         (b) Motivation Not Intended
         (c) Learning About Modelled System Domain Specific Knowledge
         (d) Domain Independent Knowledge
         (2) Mediation Of Knowledge About System’s Control
         (a) Imparting Of Procedural Knowledge
         (b) No Imparting Of Procedural Knowledge

### Game State**

a) Mutability*
   i) Static
   ii) Powerups
   iii) Experience-Levelling (XL)

b) Determinism*
   i) Deterministic
   ii) Non-Deterministic

### Objective Based Rules**

a) Topological Rules*
   i) Yes
   ii) No

b) Time Based Rules*
   i) Yes
   ii) No

c) Objective Based Rules*
   i) Yes
   ii) No

### Control*

a) Mutability*
   i) Static
   ii) Powerups
   iii) Experience-Levelling (XL)

b) Determinism*
   i) Deterministic
   ii) Non-Deterministic

### Space*

a) Environment*
   i) Dynamic
   ii) Static

b) Pace*
   i) Real Time
   ii) Turn Based

### Struggle

a) Challenge**
   i) Identical
   ii) Instance
   iii) Agent

b) Goals **
   i) Absolute
   ii) Relative

### Player Composition**

a) Player Structure*
   i) Single Player
   ii) Two Players
   iii) Multiplayer
   iv) Single Team
   v) Two Teams
   vi) Multi Team

b) Bond**
   i) Dynamic
   ii) Static

c) Evaluation**
   i) Individual
   ii) Team

### Transparency Of Simulation Model

i) Black Box
ii) Grey Box
iii) Transparent Box

### Appearance

i) Text
ii) Some Graphics
iii) 2D
iv) 3D

### User Interface

i) Browser Based
ii) Mobile Based
iii) Software Based
iv) Not Digital

### Savability

i) Unlimited
ii) Conditional
iii) None

### Virtual Space

i) Perspective
   (1) Omnipresent
   (2) Vagrant
ii) Positioning
   (1) Absolute
   (2) Relative
iii) Environment Dynamics
   (1) Free
   (2) Fixed
   (3) None

3) Target Groups, Goals Objective & Feedback

a) Width Of Target
   i) Special Target Group / Topic
   ii) Open

b) Goals Regarding Users
   i) Teaching
   ii) Evaluation
   iii) Research

c) Didactic Goals
   i) Soft Skills
   ii) Conceptual Skills
   iii) Hard Skills

d) Struggle
   i) Challenge
     (1) Identical
     (2) Instance
     (3) Agent
   ii) Goals
     (1) Absolute
     (2) Relative

e) Debriefing
   i) Collective
   ii) Individual
   iii) Absent

f) Feedback
   i) Absent
   ii) Immediate
   iii) Final

g) Feedback Degree
   i) Complete
   ii) Incomplete

4) User Relation / Community

a) Interactions Among Players
   i) Direct
   ii) Indirect
   iii) Absent

b) Player Composition
   i) Single Player
### Business Game Taxonomy

<table>
<thead>
<tr>
<th>iii) Both</th>
<th>ii) Single Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>iii) Two Players</td>
<td></td>
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<tr>
<td>iv) Two Teams</td>
<td></td>
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<tr>
<td>v) Multiplayer</td>
<td></td>
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<td>vi) Multi Team</td>
<td></td>
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<tr>
<td>vii) Massive</td>
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</tr>
</tbody>
</table>

#### c) Player Relation

i) Bond
- (1) Dynamic
- (2) Static

ii) Evaluation
- (1) Individual
- (2) Team
- (3) Both

#### d) Role Playing

i) Yes

ii) No

#### e) Players’ Community

i) Present

ii) Absent

#### f) Developers Community

i) Present

ii) Absent

#### g) Alliances

i) Foreseen

ii) Not Foreseen

iii) Not Present

#### 5) Model

a) Domain
- (1) Realistic
- (2) Fantasy

b) Behaviour
- (1) Deterministic
- (2) Stochastic

c) Generality Of Model In Regard To Domain
- (1) Special Area Of Interest
- (2) Whole Domain

d) Influence Of External Data
- (1) With Such Influences
- (2) Without Such Influences

e) Configurability Of The Model
- (1) Absent
- (2) Mixed
- (3) High

f) Fidelity
- (1) High
- (2) Medium
- (3) Low

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Table 1 shows our use of previous work by Maier & Größler (2000), Aarseth et al. (2003) and Elverdam & Aarseth (2007). BGs fit into many of the categories proposed by these authors. However, in order to add new, more significant categories without producing a large and impractical taxonomy, we chose less than half of the possible categories.
Our first step entailed choosing macro-categories, starting with those defined by Maier & Größler. The authors focused on methodological and structural issues yet did not include several crucial components such as role-playing, interactions among users and the creation of communities; thus, we added a fifth macro-category to the four offered in their paper “User Relation / Community”. Figure 2 shows briefly the critical characteristics within the five macro-categories of the taxonomy presented hereafter.

Next we present our own refined taxonomy; we define both the new elements we have added as well as those we have adopted from the other authors. Moreover, we offer disambiguation methods for those categories that may appear subjective.

**Environment of Application**

The Environment of Application category describes the spatial and temporal environment of a business simulation. In adopting Maier & Größler’s taxonomy we moved the element “Number of users” to the new category “User Relation / Community”, adding details to it and renaming it in
“Player Composition”. In addition, we removed the “Main area of application”, as we considered it too ambiguous to be defined and not critical to the aim of our study. Finally, we added a new element, the Environment.

**Degree of Integration (Stand Alone Simulation, Integration in Learning Environment)**

A BG is classified as “Stand Alone Simulation” if players are not involved in external learning experiences such as interactions with a teacher and team meetings (e.g. in BUSINESSGAME.BE no external learning experiences are foreseen); “Integration in Learning Environment” otherwise. For example in WIN WIN MANAGER, the instructor can conduct a debriefing at the end of the negotiations to improve players’ learning experience (Greco et al., 2011).

**Environment (Computer Network, Face To Face, Other)**

This element refers to the real environment in which a game is played. Players might still need to connect to the Internet or to a LAN (Computer Network) in order to play. In several cases, BGs are played “live” in a classroom (Face to Face). Finally, several less frequent cases are classified as “Other” (for example, single-player games). In several cases, players first interact "Face to Face" in order to share their opinions about a decision, and then submit their decision through a computer network or a software (e.g. in THE BUSINESS GAME the members of the teams systematically meet together to choose the strategy to be implemented in the next quarter).

**Representation (Mimetic, Arbitrary)**

A “Mimetic” representation of time refers to those games in which the time of the actions in the game mimics the time of corresponding actions in the real world (Aarseth et al., 2003). For example, WIN WIN MANAGER in its “live” version allows players to negotiate face-to-face with one other, so negotiations take time just as long as “real” negotiations would take. In most BGs, time representation is “Arbitrary”, because the time of the actions in the game does not mimic the time of corresponding actions in the real world (Aarseth et al., 2003). For example, in CAPSTONE each round corresponds to a year in the company’s life.
**TELEOLOGY (FINITE, INFINITE)**

Teleology relates to the final goal of the game. Games with “Infinite” *Teleology* never reach a clear winning state and could in principle be played endlessly (Aarseth et al., 2003). For example, in BUSINESSGAME.BE players are involved in an endless Massive Multiplayer Online Game with permanent rankings that are updated each half hour. Games with “Finite” teleology defined clearly successful outcomes for players (Aarseth et al., 2003). For example, in CAPSTONE, players have from five to eight turns (years in the BG representation of time) to compete for success with a poor-performing company.

**USE OF TEACHERS/FACILITATORS/COACHES (TOTALLY SELF-CONTROLLED LEARNING, SUPPORT BY TEACHER/FACILITATOR/COACH)**

Most BGs do not require the support by teacher, facilitator or coach, such as CAPSTONE. On the other hand, in ENTERPRISE EUROPEAN BUSINESS GAME, for example, the teams are accompanied on their path by experts, consultants, professionals, class teachers and by the national project coordinator.

**Design Elements of User Interface**

The category Design Elements of User Interface describes the characteristics of the user interface. In order to make a rigorous classification, we added many elements to Maier & Größler’s proposal, both including some from other taxonomies (Aarseth et al., 2003; Elverdam & Aarseth, 2007), and introducing new elements (Sequential Nature Of Decisions, Appearance, User Interface).

**CHANCE OF INTERVENTION WHILE SIMULATING (DISCRETE PERIODS, SIMULATION IN ONE RUN, CONTINUOUS)**

This element was proposed originally in Maier & Größler’s taxonomy (2000) without the “Continuous” label. In CAPSTONE, as well in many other BGs, players interact with the game
engine in “Discrete periods” (from 5 to 8). During our explorative research we could not find any BG in which players are supposed to interact with the game engine only once, although in some cases an instructor could opt to have players playing only one “round” or period (even if the BG allows an higher number of turns). Probably such evidence depends on the questionable learning effectiveness and low level of involvement that such design element could cause in case of “Simulation in one run”. Finally, several games allow a player to interact with a simulated environment in a continuous way, like in AIRWAY SIM. Thus, we completed Maier’s element with this new element.

**Sequential nature of decisions (Strict sequentaility, Explorative)**

From a didactic point of view, Sequential Nature of Decisions is very important. It compares the traditional, linear behaviour of games (e.g., one must complete level t to start level t+1), with the innovative, “explorative approach” that allows players to explore the game and choose their own sequence of actions. The explorative approach emerges from web-based learning applications and recurring hypertexts in a learning path. As shown in Khalifa & Lam (2002), “interactive distributed learning” web sites (i.e., hypertext-based learning material) enable a more active and explorative learning process and a higher level of understanding than the “passive distributed learning” web sites (i.e., linear material). On the other hand, the freedom of action afforded to a player can also lead to an incomplete understanding of the subject. To confront this problem, Mitsuhara et al. (2006) proposed an adaptive link generation system. Most BGs supports strictly sequential decisions, such as CAPSTONE, while others allow an explorative approach (e.g. AIRWAY SIM). One shot games are a peculiar subset of those allowing strict sequentiality of decisions.

**Characteristics of Users’ Decisions (Qualitative, Quantitative)**

Users’ decisions can be strictly quantitative (such as choosing the prices of products, as it happens in THE BUSINESS GAME) or qualitative (such as choosing the colour of products). BGs often
allow making decisions of both types (e.g. in WIN WIN MANAGER players often negotiate both about prices and qualitative variables). Nissen & Ananidze (2007) focus on the importance of qualitative decisions and argue that they are difficult to grasp with conventional simulation modelling; therefore, they presented fuzzy sets to help overcome these difficulties.

**INTERNAL TIME (Haste: Present, Absent; Synchronicity: Present, Absent; Advancing of time in user interface: Self-Proceeding, User-Driven)**

As defined by Elverdam and Aarseth (2007) “Internal time” describes time within games. “Haste describes whether the mere passing of real time alters the game state (present) or not (absent). Synchronicity describes whether game agents can act at the same time (present) or if they take turns (absent). Interval control describes whether the players decide when the next game cycle will commence (present) or if such control is denied (absent).” (Elverdam & Aarseth, 2007, p. 11). In order to make the sense of Interval control clearer we renamed it as Advancing of time in user interface. For example, in WIN WIN MANAGER, players submit their offers and counteroffers in turn (Synchronicity: Absent), the mere passing of real time does not alter the game state, because players can submit their messages until they find an agreement (Haste: Absent) and players can choose whether they want to start the next level or wait (Advancing of time in user interface: User-Driven).

**TRANSPARENCY OF SIMULATION MODEL (Black Box, Grey Box, Transparent Box)**

Most BGs are strictly black box: you don’t know how the model works. Of course in a game manual you may find that hiring one new worker will cost X $, or that machines lose efficiency at a certain rate, but you will hardly find equations that describe how offer and demand are matched, or how marketing expenses and quality affects market shares. However, the open source movement has also influenced serious gaming. Still, it’s very rare that a simulation model is fully disclosed to the public (we could not find any BG of this kind). Thus, we decided to include a “Grey Box” tag in
order to describe those games in which the models are only partially disclosed (e.g. in THE BUSINESS GAME, several characteristics of the economic model are public).

**Appearance (Text, Some Graphics, 2D, 3D)**

As graphic technology improves, the appearance of games gets increasingly realistic. The costs for a high level of virtual reality graphics are considerable, and, often, serious games developers cannot afford them. Nonetheless, as a proxy for investments in the games and as a measure of the reactivity of BGs developers to technological advancements, it is interesting to classify BGs according to their graphical characteristics. Moreover, Prensky (2007) suggests that Digital Natives, (i.e., modern learners) need multisensory, interactive and realistic environments in order to become engaged; however, there is no consensus on this conclusion (Clark & Choi, 2005). In WIN WIN MANAGER, players write text, but some graphics are provided as a feedback to them at the end of each level, then we classify it in the class “Some Graphics”. WHO WANTS TO BE A CEO? is characterized by 2D graphics. We could not find any BG extensively using 3D animations.

**User Interface (Browser Based, Mobile Based, Software Based, Not Digital)**

Most digital BGs can be played either by starting an application (Software Based) or by surfing a structured web page (Browser Based). In addition, we recently found some BGs that are playable on a mobile phone (Mobile Based). Finally, “live” BGs may not need any digital support at all (Not digital). In live BGs, players interact face-to-face, usually under the supervision of instructors that take note of their choices and behaviour. Subsequently instructors collect the data from all groups and draw conclusions from them, or use them to set up the next turn.

It will certainly be interesting to monitor the cutting-edge trend in this element of the taxonomy. For example, WIN WIN MANAGER needs a browser to be played, ICE CREAM EMPIRE has been developed specifically to be played by mobile phones and GLOBAL MANAGEMENT CHALLENGE needs Microsoft Office Excel and additional software to submit the decisions. Most
face to face games or paper-based experiential exercises such as Miles and Randolph’s THE ORGANIZATION GAME (1979) have no digital interface, while in some cases instructors may recur to spreadsheets and other software to collect data and calculate the score.

**SAVABILITY (UNLIMITED, CONDITIONAL, NONE)**

A player might be given an opportunity to stop playing and resume the game later. Such opportunities can be unlimited (you can stop and save whenever you want) or conditional (you can stop playing only under certain conditions). Finally, a player might not be able to stop the game before it is finished (e.g., live, face to face BGs). In Synchronous BGs Savability is not allowed by construction. In most BGs, such as CAPSTONE, players are free to make their calculations, but they must submit their decisions before specific deadlines, not being free to resume the game whenever they want (Conditional Savability).

**VIRTUAL SPACE (PERSPECTIVE: OMNIPRESENT, VAGRANT; POSITIONING: ABSOLUTE, RELATIVE; ENVIRONMENT DYNAMICS: FREE, FIXED, NONE)**

“Virtual Space” refers to the BG’s display space. Elverdam and Aarseth (2007, p. 7) described it as follows: “Perspective describes whether the player has a complete overall view of the game space (omnipresent) or if the avatar (or game tokens) must be moved strategically (vagrant). Positioning describes whether the player can discern his or her position exactly as the game rules dictate it (absolute) or if he or she must relate to other objects to decide his or her position (relative). Environment dynamics describes whether the player is allowed to make additions or alterations to the game space (free) or if such alterations only alter the status of predetermined locations (fixed) or finally if no changes to the game space are possible (none).” Most BGs are not characterized by a sophisticated virtual space with avatars representing players. BGs with “Text” or “Some graphics” Appearance can be conventionally characterized by “Omnipresent” Perspective, because exploring the interface does not provide any strategic advantage and “Absolute” Positioning, because there is
no avatar whose position can be related to other objects. Some BGs allow “Fixed” alterations of the Environment Dynamics, because, as the players make their choices (among a finite and fixed set of possible choices), something in the virtual space changes. Other BGs do not allow any change in the Environment Dynamics, for example in WHO WANTS TO BE A CEO? the player answers to questions and is rewarded if the answers are correct, but their answers do not change the environment. Moreover, in the same game, even though the player’s avatar can move in rooms, its path does not seem to provide any strategic advantage to the player, then Perspective can be considered “Omnipresent” and Positioning “Absolute”. We could not find any BG with “Vagrant” Perspective, “Relative” Positioning and “Free” Environment Dynamics; however we expect that in the future BGs will get more similar to contemporaneous “amusement” games, then these categories will be useful to explore trends.

Target Groups, Goal Objectives & Feedback

The third category of the taxonomy focuses on the users targeted, the goals of the simulation and the feedback provided to players as well as debriefing of players’ performances.

**Width Of Target (Special Target Group/Topic, Open)**

Some BGs such as BUSINESSGAME.BE are developed for a generic audience and do not require any specific cultural background from the players (Open). A large body of BGs is focused on specific topics, such as marketing and project management (e.g. IMPACT5 is focused on leadership) as well as special target groups (e.g. THE GLOBAL BUSINESS GAME is designed for undergraduate and graduate strategic management and international business courses).

**Goals Regarding Users (Teaching, Evaluation, Research)**

Following the definition of a BG provided earlier, a business game could teach the players (Teaching) and/or evaluate them (Evaluation). In addition, sometimes research institutions use BGs
to study the behaviour of the players (Research). For example, WIN WIN MANAGER is currently used to improve players’ negotiation skills, to evaluate their performances and to study their behaviour with scientific purposes (Greco & Murgia, 2007).

**DIDACTIC GOALS (SOFT SKILLS, CONCEPTUAL SKILLS, HARD SKILLS)**

Sukumar et al. (2007, p. 817) argue that business school courses should be designed “to ensure that students acquire the essential managerial skills identified by Katz (1974) namely, conceptual, human, and technical”. In fact, BGs are often considered as courses themselves within didactic programs. Thus, we conclude that BGs indeed can improve the following categories of skills: “Soft skills”, “Conceptual skills” and “Hard skills” (Table 2 provides some examples within each of the three categories).

<table>
<thead>
<tr>
<th>Soft (Human) Skills</th>
<th>Conceptual Skills</th>
<th>Hard (Technical) Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examples of skill</strong></td>
<td>Communication skills, leadership, empathy</td>
<td>Holistic comprehension of the enterprise environment, reciprocal influences of the processes</td>
</tr>
<tr>
<td><strong>Examples of BG</strong></td>
<td>IMPACT5</td>
<td>THE GLOBAL BUSINESS GAME</td>
</tr>
</tbody>
</table>

Table 2 Katz’s three categories of managerial skills (1974).

**STRUGGLE (CHALLENGE: IDENTICAL, INSTANCE, AGENT; GOALS: ABSOLUTE, RELATIVE)**

Challenge (Identical, Instance, Agent)

Elverdam and Aarseth describe “Challenge” as the three principal ways a game can provide opposition. “It can come in the form of predefined challenges, which are exactly the same each time the game is played (identical). It can come from a predefined framework that is varied by mathematical randomness (instance). Finally, opposition can come from game agents whose actions are autonomous (agent)” (Elverdam & Aarseth. 2007, p.13). In THE NEGOTIATOR the players can negotiate with a character by choosing among pre-defined sentences; such sentences do not change from one player to another, neither the counterpart’s reactions change, nor the sequence in which pre-defined sentences appear: thus it can be classified as “Identical”. In WHO WANTS TO BE A CEO? players can build their career through answering to questions during their exploration of spaces, answers are chosen by lot from a database, and may change from one player to another, so the game can be classified as “Instance”. In WIN WIN MANAGER, the player’s counterpart is human himself/herself too. Thus, his/her reactions are unpredictable, thus we can classify the BG as “agent”. Similar considerations can be made for all BGs where teams of players compete together, influencing a virtual market in unpredictable ways, which are different each time the game is played (such as CAPSTONE and THE GLOBAL BUSINESS GAME).

Goals (Absolute, Relative)

Elverdam & Aarseth states that: “Goals describe if the game has an exact and unchanging victory conditions (absolute) or if the goals are subjective to the unique occurrences in a specific game or the players’ interpretations (relative)” (Elverdam & Aarseth. 2007, p.14). In WIN WIN MANAGER, in each scenario, for each player scores are in the range of 0 to 200, then WIN WIN MANAGER can be classified as “Absolute” in goals. In THE BUSINESS GAME, teams compete in separate tournaments and are ranked according to a score that depends on market share and profitability. Nevertheless market share and profitability depend on the strategic choices of teams in
the tournament, so team “1” in tournament “A” may win with 700 points, as team “9” in tournament “B” may win with 100 points. Thus, THE BUSINESS GAME can be classified as “Relative” in goals.

**DEBRIEFING (COLLECTIVE, INDIVIDUAL, ABSENT)**

Debriefing is a well-known and crucial element in game based learning (Lederman & Kato, 1995) because it links the gaming experience with learning. As stated by Connolly et al. (2006, p. 105), “Debriefing provides the opportunity for learners to consolidate their experience and assess the value of the knowledge they have obtained in terms of its theoretical and practical application to situations that exist in reality. In other words, “in addition to the gaming session there needs to be a de-briefing session that helps the participants to mature or develop what they have learned” (Lainema & Nurmi, 2006, p. 113).

Unfortunately, as debriefing can be expensive, many BGs simply don’t provide it. However, when present, it is often provided collectively to a class or to a team (Collective). Alternatively (and much less frequently) it is provided individually (Individual). For example, WIN WIN MANAGER’s staff can provide both collective and individual debriefing to players about their negotiation behaviour.

**FEEDBACK (ABSENT, IMMEDIATE, FINAL)**

Garris, et al. (2002, p. 454) stipulate that, “Individual judgments and behaviour are regulated by comparisons of feedback to standards or goals”. As a mechanism for positive and negative reinforcement, feedback supports learning and influences the performances and motivations of the players. Feedback can be provided immediately following a player’s decision (Immediate) or at the end of the game (Final). It has been shown that frequent and immediate feedback benefits practice performance, but it can undermine learning with respect to task transfer (Goodman, 1998). On the other hand, feedback interventions that offer less frequent and delayed feedback can lead to poorer practice performance but better learning (Schooler & Anderson, 1990). WIN WIN MANAGER
provides an automated feedback to the player when both negotiators send to the system the output of their negotiation, so it can be classified as “Immediate” in Feedback. In THE BUSINESS GAME, while players are filling in the fields with their decisions for the next quarter, an algorithm provides decision-editing routines that inform the players whether their decisions are reasonable or not; also in this case we can classify this type of Feedback as “Immediate”. In MILLENIUM AIRLINES, players set the plans of their airlines in order to achieve their strategies; as the quarters pass by, they have only few information about the output of their decisions (such as stock prices), while at the end of the game many pieces of information are disclosed as feedback to the players, so it can be classified “Final” in feedback.

**Feedback Degree (Complete, Incomplete)**

This element reflects the level of specificity of the feedback provided. If the specificity of the feedback is very high, the player has been given very important information about his/her own behaviour (Complete). Otherwise, the information is not very specific (Incomplete). A recent study of Goodman & Wood (2004, p. 250) shows that “varying feedback specificity creates conditions for learning different aspects of a task, partially through its impact on learning opportunities during practice”. For example, in WIN WIN MANAGER, automatic feedback is focused on specific provisions included in the contract submitted at the end of the negotiation, but it does not provide information about the player’s conduction of the negotiation, being in this sense “Incomplete”. On the other hand, instructor’s feedback during debriefings can be very detailed, because it derives from the analysis of the conversations. Therefore, WIN WIN MANAGER provides through its two feedback mechanisms both “Complete” and “Incomplete” feedback. In this case, we would have classified the BG in both the dimensions, because instructor’s debriefing is an add-on to the standard version of the game.
User Relation / Community

The fourth dimension of the taxonomy describes several characteristics of the interaction amongst users. Even though “User Relation / Community” is a novel dimension that has no reference to past taxonomies, one of the elements within it - “Players Composition”- represents an evolution of Maier & Größler’s “Number of users” category.

**Interactions Among Players (Direct, Indirect, Absent)**

One player’s actions might directly influence other players’ decisions or performances (e.g., a player might sell something to another, or players within the same team can interact to choose their strategy for the next turn) or they may influence indirectly (e.g., the strategic choices of a team might change the market equilibrium lowering the share indexes of other teams’ virtual companies). Moreover the interaction and the information sharing among players could be designed in the game itself (formal interaction) or players can interact in an informal way (De Toni & Nonino, 2010). For example, in CAPSTONE, each player interacts both directly (to make the decisions within the team) and indirectly (as different teams can only submit their decisions to a central “black-box” where they interact according to unknown algorithms). Of course, in single player BGs there is no interaction among players.

**Player Composition (Single Player, Single Team, Two Players, Two Teams, Multiplayer, Multi Team, Massive)**

*Player Composition* describes how the players in a game are organized (Elverdam & Aarseth, 2007). The *Player Composition* stresses different aspects of learning. “Single player” mode can be useful to teach specific topics (e.g. EXPORT GAME helps the player to improve his/her skill in the internationalization of his/her company); “Single team” and “Multi team” modes may improve players’ attitude to cooperate and organize work in groups (e.g. in THE GLOBAL BUSINESS GAME participants can work in teams competing against others companies); “Two players” and “Multiplayer” modes are useful to improve interpersonal skills (e.g. in WIN WIN MANAGER, players negotiate one with another to improve their negotiation skills); finally, in “Massive” mode
both interpersonal and team-working skills may be improved, because players may be free to form
groups and coalitions (e.g. in AIRWAY SIM players can set up airline alliances).

**PLAYER RELATION (BOND: DYNAMIC, STATIC; EVALUATION: INDIVIDUAL, TEAM, BOTH)**

As defined by Elverdam and Aarseth (2007), “Bond describes whether the relation between players can change during play (dynamic) or not (static)” and “Evaluation describes how the players or the outcome of the game is quantified. The individual player can be evaluated (individual), the players can be evaluated as a team (team), or they can be evaluated both as a team and as individual players (both).” (p. 12). In WIN WIN MANAGER players change roles and counterparts after each level, then the Bond is “Dynamic”; each player is given a score accordingly to his/her own performance, then the Evaluation is “individual”. In THE BUSINESS GAME each team competes with the others and this structure does not change during the course of play, making the Bond “Static”; moreover, the team performance is evaluated through price/quality ratio and other measures, then the Evaluation is “Team”.

**ROLE PLAYING (YES, NO)**

A role playing game (RPG) is defined as, “[a] game where each player takes on the role of a character. The character’s story takes shape and evolves depending on the player’s decisions and choices. Role playing implies a complex interaction among the players (social interaction) or among a player and computer-controlled characters” (Greco, 2009). The use of role playing in a game can significantly increase a player’s engagement (Wishart, Oades, & Morris, 2007) which is considered an important enhancer of the learning experience (Brisson & Luckner, 1996). That said, Graham and Grey (1969, p. 18) argue that, “in one sense all gaming involves role playing”. Thus, this is a highly ambiguous element, as different evaluators could label the same business game differently. We suggest equating a BG with a “role playing game” when players must identify theirselves with their assigned role in order to be successful in the game or to consolidate the
learning. To clarify the difference, consider the two following examples. In WIN WIN MANAGER players are explicitly asked to identify themselves fully with their assigned role; they are asked to feel the characters’ background and the consequences that a bad agreement would have on their future, and to write their messages as if they were the character. Such behaviour is functional to the effectiveness of the game. On the other hand, in THE BUSINESS GAME, players have to run a virtual enterprise, but they do not need to feel and behave as if they are the Marketing Director, or the CEO of the company, although such behaviour might increase fun and improve their performances. Even when players assign themselves a role (or are assigned to it by the instructor), it is infrequent that they will interact within their team as if they really were sitting in the meeting room of an enterprise, being on first name terms.

**Players’ Community (Present, Absent)**

The most popular amusement games result in online communities where players socialize and share knowledge about the game. Sharing is not necessarily a collusive behaviour. For example, in THE BUSINESS GAME players are encouraged to share their thoughts and questions on the Facebook page of the game, while they are not allowed to disclose details about the simulation until the competition is over. The emergence of a player community is often understood as a measure of the level of engagement provided by the game. Bruckman (1998) found that in the case of virtual reality environments for constructionist learning, the community supports for such learning were more important than the environment itself.

**Developers Community (Present, Absent)**

The open-source movement has resulted in numerous communities of developers cooperating with one another, without being paid, in an effort to improve operating systems (e.g., Linux), applications (e.g., Mozilla Firefox) and web resources (e.g., Moodle). The existence of such a
community for BGs could result in a significantly accelerated rate of innovation. To our knowledge there is no evidence of stable developers communities focused on a specific business game.

**ALLIANCES (FORESEEN, NOT FORESEEN, NOT PRESENT)**

Alliances among competitors in a game can improve the knowledge sharing associated with the “Players’ Communities” mentioned earlier. In fact, members of an alliance tend to pursue a shared goal and tend to be more motivated to cooperate than do members of a community of players that are competing with each other to win. Often, the structure of a game does not allow the formation of alliances (Not Present). On occasion, even if developers did not include an “alliance formation mechanism” into the game, they can nonetheless arise spontaneously, in some cases unauthorized by the developers and/or instructors (Not Foreseen). On the other hand, developers may consider the formation of alliances as an integral and desirable part of the BG (Foreseen). For example, in THE GLOBAL BUSINESS GAME “teams can negotiate joint-venture arrangements and strategic alliances through patent licensing, subcontracts and the sale and transfer of production capacity” (http://onlinegbg.com/gbw-details.php), thus “Alliances” are Foreseen.

**Model**

This category aims to examine how the logical and dynamic models within the BG work. Some of the elements chosen by Maier & Größler (“Structure”, “Proceeding Of time in simulation Engine”, “Role of Simulation Model” and “Domain of Variables”) have been discarded because they are of little or no interest for the comprehension of a BG. Moreover their values cannot be estimated without an in depth knowledge of the model underlying the BG. The “Real-World Domain” element has been modified because all the targets of our analysis focus on business, yet we maintained a distinction between business set in a realistic, contemporaneous world, or not.
**DOMAIN (REALISTIC, FANTASY)**

This element describes whether the game setting is realistic or fantastic. It is important to point out that many BGs are set within virtual companies that do not exist in reality. Nonetheless, such games are tagged as “Realistic” when those virtual companies are at least similar to real ones or must act like real ones if they are to be economically successful. On the other hand, games set in the past (e.g. management of railroad companies in the 19th century) or in the future (e.g. management of mining companies on the moon) are tagged as “Fantasy”.

A fantasy domain might help students to abstract the more significant elements in their analyses, but the effects of a simulation that occur in a realistic domain are likely to be considered more truthful.

**BEHAVIOUR (DETERMINISTIC, STOCHASTIC)**

This element explores the behaviour of the model. Serious games are usually developed to react deterministically to a player’s decisions. From a didactic perspective, this allows the instruction to stress concepts associated with the “correct way to do something”. If the player makes a good decision, the system rewards him/her (Deterministic). In this case, a player may predict the output of the simulation exactly and understand both the rules and the patterns of the economic system. In WHO WANTS TO BE A CEO? players have to answer to specific questions, and the correctness of their answers does not vary according to any random variable.

In other cases, the main purpose of the developer is to simulate an environment realistically. Thus, negative events can happen even if a player made the correct decision or, on the other hand, a series of lucky events can support a player whose strategy was otherwise incorrect (Stochastic); in this case, the learning process focuses on the impossibility of predicting exactly subsequent stages in a game and helps the player to realize how the real-world works. For example, in THE BUSINESS GAME, the market’s overall demand varies according to periodicities, trends and random events.
Generality of Model in Regard to Domain (Special area of interest, whole domain)

Generality of Model in Regard to Domain describes whether the BG simulates the management of a company in many of its characteristics such as, marketing, finance, R&D (e.g. CAPSTONE); or if it focuses on specific topics (e.g. WIN WIN MANAGER focuses specifically on negotiation).

Influence of External Data (With such influence Without such influence)

Most the BGs that we have been able to analyse are characterised by data specific of their specific virtual environments and are not influenced by external data. However, some of them include external data, such as real euro/dollar exchange ratio, inflation ratio, etc. For example TEMPOMATIC IV recurs to the Business Week Index to tie the game to fluctuations in the real world economy (Keys and Biggs, 1990). This approach may increase both the realism of the simulations and the interest of players for contemporaneous economical and financial news.

Configurability of the Model (Absent, Mixed, High)

The configurability of the model describes to what extent the BGs’ underlying model can be adapted to the specific needs and aims of the instructor. According to Hiltunen (1998), the configurability of a system can be accomplished with three elements: design goals, links within the system and modifications of the user interface. By referring only to the model, several aspects of a BG can be modified: the user decisions, the feedback system and the business environment. For the user, changing the model means the adoption of different learning goals. We define High Configurability as a situation in which most aspects can be changed. In THE BUSINESS GAME, the instructor can choose the number of teams, the number of quarters, the number of markets, special events happening during the game (such as strikes and demand dynamics), the number of strategic levers and many other parameters of the game, thus in this case we consider “High” Configurability of the model. When only a small amount of the variables can be changed according
to the instructor’s directions we consider the Configurability of the model as “Mixed”. Nonetheless, most models are not configurable at all (Absent).

**Fidelity (High, Medium, Low)**

Alexander et al., (2005) defined fidelity as, “the extent to which the virtual environment emulates the real world”. The fidelity of a game is strongly related to a model’s behaviour, as the presence of stochastic behaviour can be considered an element of realism. Often, graphics are considered important to augmenting the realism of a simulation.

The importance of verisimilitude and plausibility in a simulation model has been described previously by Kibbee (1961) and Boocock (1972). Similarly, Sutcliffe (2002, p. 22) stipulates that, “If students regard a simulation as ‘unrealistic’, they are unlikely to regard its predictions as relevant to their understanding of the real world”. Indeed, in this situation learning goals are missed. Nonetheless players might consider “unrealistic” a high-fidelity game just because they do not get the results they wanted from their decisions.

We have defined fidelity as a weighted sum of several other elements in our taxonomy, in order to measure it in an objective way although this might increase the redundancy of our model. Nevertheless this indicator provides new and important information about the business game. Starting from the above theories and employing six elements (along with the corresponding weights), we are able to obtain a clear definition and determination of fidelity:

- **Behaviour** (Deterministic, 1; Stochastic, 6): And high fidelity BGs should be able to simulate the uncertainties of reality; the introduction of random variables may achieve this aim.

- **Interaction** (Direct, 6; Indirect, 3.5; Absent, 1): indirect interactions need an engine to compute data provided separately by the players; such engine needs to simplify the
matching process of such data, while direct interactions among players may turn in a more complex and indeed more realistic behaviour.

- **Player Composition** (Single Player, 1; Single Team, 1; Two Player, 2; Two Team, 3; Multiplayer, 4; Multi-team, 5; Massive, 6): the more player are involved in the BGs, more complex may be their interactions (e.g. with the formation of coalitions).

- **Challenge** (Identical, 1; Instance, 3.5; Agent, 6): the higher the level of opposition provided by the BG, the higher will be the realism of the simulation.

- **Didactic Goals** (Soft Skills, 3.5; Conceptual Skills, 1; Hard Skills, 6): while the development of conceptual skills may tolerate a simplified environment (e.g. if the game is supposed to provide an holistic comprehension of an enterprise, some details such as product packaging, negotiations with Union and the appearance of the company web page can be omitted) the development of soft skills will need specific details to be introduced in the scenario (for example, in a negotiation game players should be given specific information about their alternatives, counterparts etc.); finally, hard skills need very specific and detailed information that should match those of the real world (e.g. if the game is supposed to teach specifically logistics management, all the relevant variables should be included in the simulation).

- **Appearance** (3D, 6; 2D, 4; Some Graphics, 2; Text, 1)

Thus, we have an upper limit of 36 points and a lower limit of 6 points within which we define the different levels of fidelity:

- High Fidelity, when the score is higher than 27 ($27 \leq X \leq 36$)
- Medium Fidelity, when the score falls between 17 and 26 ($17 \leq X \leq 26$)
- Low Fidelity, when the score is less than 16 ($6 \leq X \leq 16$)
Conclusions, limits and future research directions

We believe that our research represents an accurate synopsis of what is otherwise heterogeneous literature about BGs. We answered to our first research question through a novel definition of “business game” that focuses on the goals of each game rather than on its technical characteristics. Then we answered to our second research question through a taxonomy based on the literature from both game based learning and management fields. The taxonomy presented in this manuscript consists of close to forty elements, and although this is a relatively large number, we believe it is the minimum necessary for a comprehensive description of a business game. Table 3 shows an application of our taxonomy to five different BGs cited in this article. Table 3 has been compiled by three different respondents who had developed a game, and/or played it, and/or read scientific or informative articles about it. The matching of the three respondents’ answers did not show any incompatibility, while developers provided additional information (e.g. players of the online versions of WIN WIN MANAGER and THE BUSINESS GAME were not aware of their “Face to Face” editions).

<table>
<thead>
<tr>
<th>1. Environment of Application</th>
<th>WIN WIN MANAGER</th>
<th>THE BUSINESS GAME</th>
<th>WHO WANTS TO BE A CEO?</th>
<th>CAPSTONE</th>
<th>TOP MANAGEMENT DECISION SIMULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Degree of integration</td>
<td>i. Stand-alone simulation</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>ii. Integration in Learning environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Environment</td>
<td>i. Computer Network</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>X</td>
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<tr>
<td></td>
<td>ii. Face to Face</td>
<td>x</td>
<td>x</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>iii. Other</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>c. Representation</td>
<td>i. Mimetic</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii. Arbitrary</td>
<td>x</td>
<td>x</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td>d. Teleology</td>
<td>i. Finite</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>ii. Infinite</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Use of teachers/facilitators/coaches</td>
<td>i. Totally self-controlled learning</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>ii. Support by teacher/facilitator/coach</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>2. Chance of intervention while simulating</td>
<td>i. Discrete periods</td>
<td>x</td>
<td>x</td>
<td>X</td>
<td>x</td>
</tr>
</tbody>
</table>
### Business Game Taxonomy

#### b. Sequentiality

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>i. Strict Sequentiality</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>ii. Explorative</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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</table>

#### c. Characteristics of Users’ Decisions

<p>| | | | | | |</p>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>i. Qualitative</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>ii. Quantitative</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

#### d. Internal Time

<table>
<thead>
<tr>
<th>i. Hasten</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Present</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>(2) Absent</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ii. Synchronicity</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Self-Proceeding</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>(2) User-driven</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
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</tbody>
</table>

#### e. Transparency of Simulation Model

<p>| | | | | | |</p>
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<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>i. Black box</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>ii. Grey Box</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>iii. Transparent box</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

#### f. Appearance

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>i. Text</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>ii. Some graphics</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>iii. 2D</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>iv. 3D</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

#### g. User Interface

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Browser based</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>ii. Mobile based</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>iii. Software based</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>iv. Not Digital</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

#### h. Savability

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>i. Unlimited</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>ii. Conditional</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>iii. None</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

#### j. Virtual Space

<table>
<thead>
<tr>
<th>i. Perspective</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Omnipresent</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>(2) Vagrant</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ii. Positioning</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Absolute</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>(2) Relative</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>iii. Environment Dynamics</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Free</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>(2) Fixed</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>(3) None</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

#### a. Width of Target Group

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Special target group</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
### Business game taxonomy

#### 33

**b. Goals regarding users**

| i. Teaching | x | x | x | x | x | x |
| ii. Evaluation | x | x | x | x | x | x |
| iii. Research | x |

**c. Didactic goals**

| i. Soft skills | x | x |
| ii. Conceptual skills | x | x | x | x |
| iii. Hard Skills |

**d. Struggle**

| i. Challenge | (1) Identical | x |
| (2) Instance |
| (3) Agent | x | x | x | x |

**d. Struggle**

| i. Goals | (1) Absolute | x | x | x |
| (2) Relative | x | x |

**e. Debriefing**

| i. Collective | x | x | x | x |
| ii. Individual | x |
| iii. Absent | x |

**f. Feedback**

| i. Absent |
| ii. Immediate | x | x | x | x | x |
| iii. Final | x |

**g. Feedback degree**

| i. Complete | x | x | x | x | x |
| ii. Incomplete | x | x | x | x | x |

**a. Interactions Among Players**

| i. Direct | x | x | x | x |
| ii. Indirect | x | x | x | x |
| iii. Absent | x |

**b. Player Composition**

| i. Single person | x |
| ii. Single Team |
| iii. Two player |
| iv. Two Team |
| v. Multiplayer | x |
| vi. Multi Team | x | x | x |
| vii. Massive |

**c. Player Relation Bond**

| i. (1) Dynamic | x |
| (2) Static | x | x | x | x |

**c. Player Relation Evaluation**

| i. (1) Individual | x | x |
| (2) Team | x | x | x | x |
Table 3 – An application of the taxonomy to five BGs. A quantitative estimation of fidelity is enclosed in parenthesis in the corresponding cells of the element 5.f.

Our taxonomy, based on the principal classifications represented in the literature, could be refined further through an in-depth analysis of the state of the art of the business game industry (both past and present), that could raise the need of additional categories. Our future research will be directed to overcome this limit by an effort to categorize the totality of BGs used in learning (or at least a major part of them). In fact, the taxonomy we have proposed was guided by one main objective: to
understand the current state of the art and describe its evolutionary path by comparing the very first business games created with contemporaneous ones. Table 3 showed an interesting comparison among THE TOP MANAGEMENT DECISION SIMULATION and four other contemporaneous BGs.

Several scholars in the past have provided descriptions of BGs (Table 4).

<table>
<thead>
<tr>
<th>Number of BGs Reviewed</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 100</td>
<td>Kibbee et al., 1961</td>
</tr>
<tr>
<td>183</td>
<td>Graham &amp; Gray, 1969</td>
</tr>
<tr>
<td>Over 300</td>
<td>Zuckerman &amp; Horn, 1971</td>
</tr>
<tr>
<td>228</td>
<td>Horn &amp; Cleaves, 1980</td>
</tr>
<tr>
<td>354</td>
<td>Elgood (1997)</td>
</tr>
</tbody>
</table>

Table 4 - Reviews about business games.

However, Elgood’s (1997) assessment of the (then current) number of BGs was the most recent we could find. We suggest that a single research group cannot build a complete list of the BGs. In fact, information about non-digital BGs is difficult to find, especially if the games were developed before the nineties. In addition, many BGs are not developed in English and are poorly optimized for search engines. Finally, the compilation of Table 3 showed that playing to a BG or reading about it could not be sufficient to identify properly all its characteristics, then the cooperation of developers is needed. Thus, in our opinion, in order to obtain a large and reliable database of BGs, a collaborative approach involving the entirety of the scientific and development communities will be required. Such collaborative approach may enhance the creation of communities of innovation (Grimaldi, Cricelli & Rogo, 2012) improving the existing BGs and creating new ones.

Our five-part taxonomy will be used to develop an international and open database. Such a database will allow for the identification of meaningful trends in the development BGs. Moreover, it will
become a worldwide showcase for business games, and it will be capable of supporting the focused research needs of business schools and managers alike.

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We would like to thank the two reviewers and Prof. Faria for their detailed comments. We believe that their insightful suggestions dramatically improved our article. We would like also to thank Giorgio Fioretti and Sara Mattioli for their support.

**Declaration of Conflicting Interests**

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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