Classifying Serious Games: the G/P/S model

Damien Djaouti, Julian Alvarez, Jean-Pierre Jessel
IRIT – University of Toulouse, France

ABSTRACT

The purpose of this chapter is to introduce an overall classification system for Serious Games. The intention of this classification is to guide people through the vast field of Serious Games by providing them with a general overview. For example, it may appeal to teachers who wish to find games with strong educational potential though they may be outside the "edugames" field.
We will start by discussing the definition of Serious Games, and define them as having a combination of "serious" and "game" aspects. This theoretical framework will be used to review previous classification systems and discuss their limitations. We will then introduce a new classification that addresses a number of these limitations: the G/P/S model. This classifies games according to both their "serious-related" and "game-related" characteristics, and combines the strengths of several previous classification systems.

Keywords: Serious Games, Video games, Definition, Classification, Gameplay, Purpose, Scope, Education.

INTRODUCTION

During the last 10 years, an increasing number of Serious Games have been released which relate to a wide range of fields: healthcare, defense, education, communication, politics, etc. When any topic becomes suddenly available with a wide variety of options, it encourages a natural desire to classify it. And there are several studies that propose classifying Serious Games, but classification is not an all-purpose tool. And where several classification systems exist, it is usually because each system is able to fulfill only one specific need. As the focus of this book is Education, the first question is: what educational-related needs can be addressed with a classification system suited to Serious Games?

Several answers come to mind. The most obvious is to assist teachers by classifying games according to the cognitive skills they support (e.g. repetitive task, memory, exploration, etc.). Such systems are closely related to Instructional Design, as illustrated by the work of O'Neil (2005). In addition to the classification of games already identified as "educational", classification systems may also be used to discover games featuring an educational potential without being explicitly labeled as "educational". For example, in the vast field of Serious Games, many games that were not designed for "education" could be used in a classroom (Gee, 2003). Indeed, as defined by Chen & Michael (2005), Serious Games are *"Games that do not have entertainment, enjoyment or fun as their primary purpose"*. The "seriousness" of these games refers to a content that may well be used as teaching material by teachers. These games could also be used to teach media literacy, by showing people that video games are not "neutral" and that they could include a "serious" content (Matteas, 2008). For teachers or educators who wish to use games

in this way, the question is: how can we identify games with an educational potential if they are not labeled as “educational?”

In this case, the use of an overall classification system for Serious Games may well be of assistance. Unlike systems that are focused solely on one field, such as education, overall classifications are designed to classify any Serious Game by the same set of criteria. As they provide a “broad view”, they can help teachers to identify games that are not labeled “educational” despite the fact that they may be relevant to classroom use.

Therefore, the aim of this chapter is to propose an overall classification system that teachers can use to identify easily and analyze Serious Games. After a brief discussion about the definition of Serious Games, we will explore several previous classifications. This analysis will highlight the clues that may be used to create a new system designed to analyze Serious Games: the G/P/S model. Finally, to illustrate this, a sample set of Serious Games will be classified using the G/P/S model. And in order to help teachers find games with a strong potential for education outside of the “edugames” field, classified examples will be taken from a wide range of the Serious Games markets.

DEFINING SERIOUS GAMES

A definition of Serious Games

There are several definitions of “Serious Games”. The first formal definition of the concept would appear to have been introduced by Abt (1970). In his book, Abt presents simulations and games to improve education, both in and outside of the classroom. The examples he provides are either “mainframe computer” or “pen-and-paper” based games, as the video game industry was not yet established. Abt’s book influenced other teachers, like Jansiewicz (1973) who published a book describing a game he invented to teach the basics of US politics. Several years later, the concept of the “Serious Game” was redefined in a white paper written by Sawyer (2002). His updated definition of Serious Games is based on the idea of connecting a serious purpose to knowledge and technologies from the video game industry. In association with Rejeski, Sawyer helped to shape the current “Serious Games” industry through the *Serious Game Initiative*, and conferences like the *Serious Game Summit* and *Games For Health* (Sawyer, 2009). Nowadays, most recent definitions, like those of Chen & Michael (2005) and Zyda (2005), appear to stem from Sawyer’s influence. Although the general definition of “Serious Game” appears to be shared by many people, the domain boundaries of the Serious Games field are still subject to debate. As discussed by Corti (2007), the “Serious Game” industry brings together participants from a wide range of fields, such as Education, Defense, Advertising, Politics, etc. who do not always agree on what is and what is not a part of the Serious Games industry. To reflect these differences, some “domain-specific” definitions are used to force a limited view of the nature of “Serious Games” (Sawyer & Smith, 2008). However, a common line may still be drawn across all professional fields despite these territorial debates. Serious Game designers use people’s interest in video games to capture their attention for a variety of purposes that go beyond pure entertainment. Therefore, although the main focus of this book is Education, throughout the chapter we will rely on a broader definition of “Serious Games”: any piece of software that merges a non-entertaining purpose *(serious)* with a video game structure *(game)*.

Differences between Serious Games and Entertainment Games

In the light of the previous definition, we can try to differentiate “Serious Games” from “Entertainment Games”. Just as we defined a Serious Game as being a piece of software combining both “serious” and “game” dimensions, we can define an entertainment video game as a piece of software featuring only a “game” dimension. For example, the game *Trauma Center: Under the Knife* [1] casts players as surgeons and asks them to operate on patients. However, aside from the hospital theme and certain references to real-life surgical equipment and techniques, the game was not designed with an explicit “serious-purpose” scenario. In this game, healthcare is used only as a background to build an entertaining game scenario. On the other hand, *Pulse!!* [2] is very different, even though the players are also cast as doctors. The designers of *Pulse!!* have introduced a doctor-training scenario into the game scenario, in order to provide a serious purpose for the game. The differences are even more evident when playing these two games. Whilst *Trauma Center: Under the Knife* asks players to use a laser on their patients’ hearts to kill dragon-shaped viruses, *Pulse!!* provides them with real-life cases that have to be solved using current medical techniques.

However, there is nothing to prevent players from using *Trauma Center: Under the Knife* with a serious intention in mind. And the same goes for any commercial “off the shelf” game that is subsequently used to serve a serious purpose. This kind of “purpose-shifting” is very common in education where some teachers use entertainment video games as teaching materials. Comprehensive examples of such “purpose-shifting” for Education are detailed and discussed in (Gee, 2003) and (Shaffer, 2006). A similar example, related to Healthcare, is given by the psychologist Michael Stora (2005) in his book “Healing through virtual worlds”. During therapy sessions with children, he uses the game *ICO*[3] by “shifting” its original entertainment purpose. At some point in this game, the player must hold the hand of a princess *(by keeping a button pressed down on the gamepad)*, and guide her to the exit. In order to finalize his task, the player must then release the button and let the princess go away. The therapist observes the reaction of children when they have to perform this task. Some children become confused and refuse to abandon the princess. Then, Stora begins a dialogue with these children, using the game as a metaphor for their own familial experience.

Nevertheless, there remains a major difference between those games used to perform “purpose-shifting” and games crafted by the “Serious Games” industry. Video games used for “purpose-shifting” were not designed to serve a serious purpose, but purely for entertainment. This argument might be cited by some designers in order to exclude the “purpose-shifting” of commercial “off the shelf” games from the “Serious Game” movement. However, when teachers use entertainment video games for their lessons, to an extent they create their own “serious scenario” which they introduce alongside the play sessions of their students. This “serious” dimension is not directly embedded in the game, but the teacher uses it to influence the way his/her students might play. Thus, we can consider that the “serious” and the “game” dimensions are both present in the “purpose-shifting” approach, and that the real difference between a “Serious Game” and a game used for “purpose-shifting” lies in the design process. Teachers are obliged to take a game scenario previously designed and adapt it to their “serious” goals, whilst designers from the Serious Games industry have full control over the content of their games.

Halfway between “purpose-shifting” and games that are designed from scratch to serve a serious purpose, there are some Serious Games that are built as software modifications *(called “mods”)* of entertainment video games. For example, *Escape from Woomera*[4] is a software modification of the video game *Half-Life*[5]. The “game” scenario of *Half-life*, which originally referred to fighting an alien invasion, was transformed to give “serious” information about the difficult living conditions in an

Australian immigration centre. The main difference between “mods” and Serious Games designed from scratch is the relationship between the designers of both the “game” and the “serious” dimensions. Whilst the designers of *Pulse!!* had full creative control over the design of both the “serious” and the “game” dimensions, the designers of *Escape from Woomera* designed only the “serious” dimension which they then had to fit into a pre-existing “game” scenario not originally crafted by them.

To summarize, we can still define entertainment video games as software applications featuring only a “game” dimension. In addition to the “Serious Games” designed from scratch by the “Serious Games” industry, there are two alternative methods that can be used to add a “serious” dimension to a pre-existing game. Both “purpose-shifting” and “mods” seem relevant to the spirit of “Serious Games”. However, as “purpose-shifting” can be applied to virtually any piece of software, we will draw a line between software designed with both “serious” and “game” dimensions and software designed solely with a “game” dimension. To be relevant to the “Serious Game” category, software must be designed with both “serious” and “game” dimensions. These two dimensions can be designed from scratch by the same team or by a number of other unrelated people through the use of “mods”. When a game that is designed for entertainment is used with “purpose-shifting” to serve a serious purpose, no software modification is involved. Referring to Jenkins (2009), to emphasize the difference between “purpose-shifting” and the other approaches, we propose the creation of a broader category called “Serious Gaming”. This category brings together “purpose-shifting” and “Serious Games”. Whereas “Serious Games” is a label that refers to applications featuring both a “serious” and a “game” dimension within the software, “Serious Gaming” is a label that refers to any video game used for “serious” purposes, whether the “serious” dimension is or is not designed within the software.

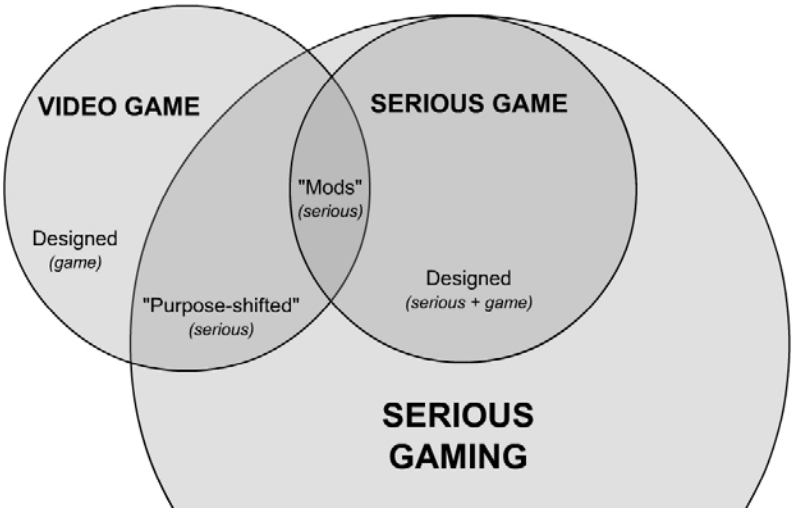


Fig 1. The relationship between Video games, Serious Games and Serious Gaming

As an aside, it can be argued that the presence of the “serious” dimension depends on the subjective assessment of the game by the player. For example, players of a Serious Game can fail to identify the serious purpose that the game intends to serve. In such cases, when the “seriousness” of a game appears unclear, we suggest referring to the intention of its designers rather than to the perception of the players.

CLASSIFIYING SERIOUS GAMES

Since 2002, several methods and tools have been introduced to classify Serious Games. Each of these methods endeavours to address the issues of its predecessors. However, no classification system has yet achieved a level of general acceptance. In this section, we will present some of these systems, and attempt to highlight their respective limitations.

From a chronological point of view, the first classification systems were based on a single criteria. As pointed out by Sawyer & Smith (2008), these models can be divided into two categories: market-based classifications and purpose-based classifications.

Market-based classifications

These classification systems are designed to index games according to the "markets" which use them (i.e. the kind of people who play them). Here are some examples of market-based classifications:

- In a 2005 article, Zyda (2005) divided Serious Games into five domains: *Healthcare, Public policy, Strategic Communication, Defense, Training & Education.*
- In their 2005 book, Chen & Michael (2005) classified Serious Games according to markets, in eight different categories: *Military Games, Government Games, Educational Games, Corporate Games, Healthcare Games, Political Games, Religious Games, Art Games.*
- In a 2008 study, Alvarez & Michaud (2008) identified seven Serious Games markets, quite similar to those mentioned above: *Defense, Training & Education Games, Advertising, Information & Communication, Health, Culture, Activism.*

Albeit very useful, these market-based classifications suffer from two limitations. First, due to the discovery of new markets for Serious Games, their boundaries continue to expand. Secondly, these classifications are based solely on the applications of Serious Games rather than on the games themselves. In other words, market-based classifications are able only to inform about the uses of Serious Games, not about their content.

Purpose-based classifications

Alongside the classifications based on the uses of Serious Games, there are systems based on the intention that each Serious Game was designed to satisfy: the "purpose". Some examples of such classifications include:

- In his 2006 book, Bergeron (2006) presented seven "purpose" categories: *Activism games, Advergames, Business Games, Exergaming, Health and Medicine Games, News Games, Political Games.*
- In a 2008 article, Despont (2008) proposed a typology of four Serious Games "purposes": *Advert Games, Institutional Serious Games, Business Games, Learning Games.* This typology is based on another typology by the same author, which identified six "serious intentions": *to increase awareness, to simulate, to train, to inform, to teach* and *to influence*[6].
- In our own previous work, we (Alvarez & al., 2007) also introduced six "purpose" categories for Serious Games: *Edugames, Advergames, Newsgames, Activism games, Edumarket games, Training & Simulation games.*

While they are still based on a single criteria, purpose-based classifications are harder to use than market-based ones. In each of the above models, categories seem heterogeneous. For example, *"Health and Medicine Games"*, *"Institutional Serious Games"* and *"Business Games"* are tied to the "targeted

market" of the game, while categories such as *"Edugames"*, *"Learning Games"* and *"Exergaming"* are clearly based on the "purpose besides entertainment" and are features of the game. Overall, these systems are an interesting step towards understanding the purpose of Serious Games. They encourage separating "purposes" from "markets", which at first is not an obvious distinction. Unfortunately, they suffer from heterogeneous categories that prevent them from being a reliable source for general classification. Hopefully, these systems opened a path for multiple criteria classifications by introducing models that went further than a simple market analysis of the game. More importantly, they helped to shift the classification focus onto the "contents" instead of the "uses".

A multiple criteria classification

The complementary nature of the criteria used in the market-based and purpose-based classifications inspired a system based on multiple criteria: the "Serious Game Taxonomy". Introduced by Sawyer & Smith (2008), this global taxonomy indexes Serious Games according to two criteria:

- **Market:** *Government & NGO, Defence, Healthcare, Marketing & Communication, Education, Corporate, Industry.*
- **Purpose:** *Games for Health, Advergames, Games for Training, Games for Education, Games for Science and Research, Production, Games as Work.*

Each "purpose" category also comes with a "sub-taxonomy" whose complexity varies greatly from one "purpose" to another. At first glance, this global taxonomy uses 49 categories, plus many additional sub-categories. This taxonomy cleverly analyzed and merged previously available classification systems. It is more complex to use than single-criterion systems, but it provides a better understanding of Serious Games through a more precise categorization. Shaped as a table, this "Serious Game Taxonomy" is also useful to detect "empty fields", i.e. a combination of "market + purpose" that lacks any Serious Game reference.

Nevertheless, this system also suffers from certain issues. For example, the "purpose" criterion appears not to be sufficiently accurate, as a game such as *September 12th* falls outside of its scope. Furthermore, some "market" and "purpose" categories overlap. These issues appear to be inherited from previous single criterion classifications, especially the "purpose-based" ones which suffer from similar limitations.

In addition to "purposes" and "markets"

Either based on one or two criteria, all of these classifications focus on two aspects of Serious Games: the purpose they are designed to serve and the kind of market that uses them. Overall, these systems are a simple way to present an overview of the Serious Games field. However, they all suffer from a major limitation of their scope - none of these systems classifies "Serious Games" as "games". Indeed, no classification presented in this section can provide relevant information about the game structure of the games it classifies.

As discussed in the previous section, Serious Games are defined by the combination of a "serious" dimension and a "game" dimension. The systems we have just reviewed are solely focused on the analysis of the "serious" side and disregard the "game" aspect. It may be just that the "game" dimension is not relevant to classify games. But since the beginning of the entertainment video game industry, video games have had a strong impact on the general public and have led to the birth of a rich video-gaming culture, with several game styles, genres and design approaches. Moreover, several classifications of

entertainment video games have been introduced since the early 80's. Therefore, can these classifications that focus on the "game" dimension help classify Serious Games?

Classifications of Entertainment Video Games

Systems designed to classify entertainment video games come from various sources such as academics, designers, editors, the gaming press or even experienced players. The most common approach to classify video games is to categorize them into "genres".

The first kinds of such genre-based classifications originate from players and the gaming press, and are called "freeform classifications". As their name implies, they are crafted from a subjective and empirical analysis. They led to the emergence of numerous classifications that share similar structures, but rely on different definitions[7] and different genres[8]. Although they are an important part of the global video game culture, these classifications are too numerous and too focused to be used as a reference. Looking at this wild group of "freeform classifications", several designers and academics tried to refine them through critical thinking, in order to produce more reliable "genre-based" classifications. We can for example refer to Crawford (1982), Myers (1990), LeDiberder (1993), Wolf (2002), Rollings & Adams (2003) and Natkin (2006), among others. While these studies resulted in improved classification systems, unfortunately they failed to create a consensus, essentially because each system was different from its predecessor… Nevertheless, as these classifications are established and explained, unlike the "freeform classifications", they provide an interesting historical resource for the evolution of video game genres.

After a review of these "genre-based" classification systems, studies like Letourneux (2005) and Apperley (2006) highlighted their flaws, and called for a new approach to video game classification. As a result, a few recent classifications are not based on "genres". For example, Strange Agency (2006) introduced a system which classifies games according to the analysis of what the player does during play. This classification defines forty-nine possible activities such as *Driving*, *Collecting*, *Management*, *Building*, *Puzzling*... These categories are then quantified for each game, in order to create an "activity profile" that provides a high level of detail on how the game feels from a player's perspective. Elverdam & Aarseth (2007) proposed a classification built on a typology of video games with 17 dimensions, such as *Goals*, *Challenge*, *Synchronicity*, *Savability*... Each of these dimensions is a criterion with a finite set of values, and can be used to classify game mechanics in a detailed manner. This classification is an update of the multi-dimensional typology of video games introduced by Aarseth (2003). However, such complex and accurate systems are more suited for in-depth analysis of the game structure than overall classification.

To summarize, the analysis of the game structure is possible and indebted to many different approaches, from free-form "genre classifications" to "mechanics analysis" systems. Because the video game culture continues to spawn new kinds of games, several studies continue to be conducted on the classification of video games. As an unfortunate consequence, the large choice of available tools makes it impossible to refer to just one classification system. For our current study, not all of these systems can be used directly but they do offer interesting alternatives. Classifying a set of Serious Games with any system referred to in this section will generate a very different result from that which can be obtained by classifying those same games with the systems presented in the previous section. On one hand, it will bring together games that share similar play principles and on the other it will bring together games with similar purposes or uses. But, in both cases, there is one area of information that is lacking: Serious

Games are defined by both a “serious” and a “game” dimension, and all the systems we have presented so far focus on one single dimension at a time. In order to build an overall classification system for Serious Games, we should try surely to try to define a classification system that uses both dimensions at the same time.

A CLASSIFICATION OF BOTH “SERIOUS” AND “GAME” DIMENSIONS

From an overall perspective, to classify Serious Games with more precision, we propose a new classification model that combines the analysis of both “serious” and “game” dimensions: the G/P/S model

The Gameplay / Purpose / Scope (G/P/S) model

Referring back to our observations concerning definition, a Serious Game is composed of both a “serious” and a “game” dimension. To combine both dimensions, the G/P/S model extends the “Purpose & Market” paradigm by the addition of a “Gameplay” related criterion. More specifically, the G/P/S model relies on three aspects:

- **Gameplay,** which refers to the type of gameplay used. This aspect is intended to provide information about the game structure of the Serious Game: how it is played.
- **Purpose,** which refers to the designed purpose. This aspect accounts for the eventual purpose(s) apart from entertainment intended by the designer of the Serious Game.
- **Scope**, which refers to the targeted application(s) of the title. This aspect suggests the actual use(s) related to the Serious Game: the kind of market, the audience… who uses it.

These three aspects, defined in the G/P/S model, can be used to build criteria suitable for the classification of any video game. The model places serious and entertainment games on the same footing (i.e.) any video game can be defined by a gameplay structure, a targeted scope of use, and an optional “purpose” apart from entertainment. These criteria are detailed below.

Gameplay

As observed above, the notion of “genre” is an important part of the video-gaming culture, but is used mainly in subjective free-form classifications. Therefore, instead of relying on empirical “genre-based” analysis, we will try a different approach to the “game” side of Serious Games. This approach will focus on a fundamental notion of the “game dimension”: the **gameplay.**

Defining gameplay is a complex task. Among academics, game designers, the gaming press and even players, no single definition of this concept has yet reached a state of consensus. Historically, the word is assumed to derive from the expression *“How the game plays?”*, which was the title of instructions written on early arcade cabinets. From an empirical point of view, this concept seems tied to the way the game is played. But it may also be used to talk about the general play experience of some players. From the various definitions available, we will refer to the one proposed by Portugal (2006), a Serious Game designer. He defines “gameplay” as the combination of five components: *Rules, Input methods, Space-related setup, Time-related setup, Drama-related setup*[9].

To build a classification based on gameplay, we will try to define a criterion based on one of these components: *Rules*. The "Rules" component is very interesting for classification tasks because its "logical" nature makes it eligible for formal deconstruction. In some studies of "Ludology" [10], a distinction is made between several "kinds" of rules. We will begin to define a standard from these "different kinds of rules".

An initial distinction can be made between two forms of "play", as introduced by Caillois (1962): a play form framed by a defined set of rules, called *ludus*, and a more freeform kind of play called *paidia*. In fact, these two forms are related to the definition of the words "game" (ludus) and "play" (paidia), and apply to any kind of play/game structure (board game, card game, toys, etc.).

Both of these forms of play also exist in video games and are tied to the kinds of rules used to design the games. *Sim City*[11] is a common example of a "play-based" (or "videotoy") type of game, whereas *Pac-Man*[12] is "game-based". The main difference between the rules of these two titles is that *Sim City* lacks any rule defining "goals": it cannot be "won" or "lost". Furthermore, as it has no goals to aim for, the performance of the player will not be appraised by this video game, whereas *Pac-Man does* incorporate goals *(eat all the pills and avoid the ghosts)* and these are used to provide a positive *(score increment)* or negative *(life loss)* feedback to the player. Hence, a video game lacking "goals" will be considered as **"Play-based"**, whereas a video game featuring "goals" will be considered as **"Game-based"**. In the examples detailed in the last section of this chapter, *September 12th* is "Play-based", while all the others are "Game-based".

This information on the nature of gameplay appears to be quite relevant to several cases of Serious Game applications. For example, in the first part we discussed the "purpose-shifting" conducted by some teachers to add a virtually "serious" dimension to entertainment based "off-the-shelf" commercial video games. Though it is not always the case, "purpose-shifting" might be easier to perform with "Play-based" titles than with "Game-based" ones. Because this type of video game does not feature stated goals, a teacher can propose his own goals quite freely when he introduces the game to the classroom. With "Game-based" titles, a teacher must react to goals designed previously, which means he has to adapt his teaching to the game, or choose a different video game.

A more detailed discussion on the *paidia/ludus* duality is presented by Frasca (2003), which expands his analysis by proposing a typology of the rules found in video games. Additionally, several studies deal extensively with different kinds of video game rules, such as Salen & Zimmerman (2003), Juul (2005), Djaouti & al. (2008) and Järvinen (2008). These studies feature relevant information on the nature of rules, and provide clues that can help to build a more detailed criterion based on them.

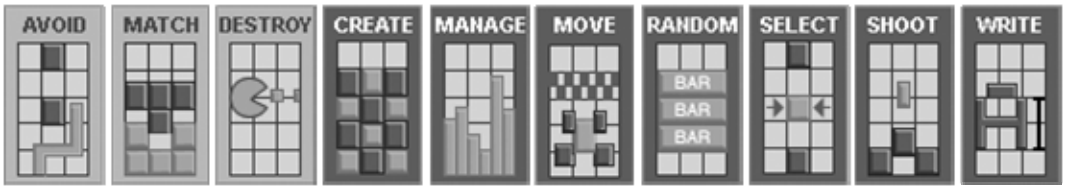
In 2006, we introduced such a criterion to build a video game classification according to gameplay. Briefly, we conducted a formal breakdown of "Rules", in order to find recurrent structures that could lead to a viable standard. After analysing the rules of 600 video games, we were able to highlight a set of "primary rule patterns" that could be combined to represent the fundamental rules of video games. For convenience, each of these "rule patterns" was shaped into a "GamePlay brick", named after verbs.

For example, the two games *Pac-Man* and *Space Invaders*[13] feature the following rules:

- *"If Pacman collides with Ghost, then destroy Pacman"*.
- *"If Spaceship collides with Enemy's shot, then destroy Spaceship"*.

We observe a very strong similarity between these rules and therefore are able to consider that they are built on the following pattern: *"If the player element collides with a hostile element, then there is a negative feedback towards the player element"*. For simplicity, this "rule pattern" is then shaped into a "gameplay brick" named "Avoid". This summarizes the rule into a single verb. As discussed above, the rule patterns identified through bricks are of two kinds: *"Game bricks"*, which state the goals to achieve, and "*Play bricks*", which define the means and constraints for reaching these goals. Currently, a set of 10 combinable bricks have been identified:

- **Stated Goals**: Avoid, Match, Destroy.
- **Means & Constraints**: Create, Manage, Move, Select, Shoot, Write, Random.



A detailed presentation of the 10 bricks and the "rule patterns" that define them can be found in (Djaouti & al., 2008). Concisely, these "GamePlay bricks" are able classify the basic rules used in a video game and provide an overview of how the game plays. Note that there are more complete systems referred to in the section about entertainment games, but their high level of detail makes them difficult to use in a classification suited for a general overview.

To summarize, the analysis of gameplay "rules" provides several ways to classify video games, with differing levels of accuracy. An initial distinction can be made between "Game-based" and "Play-based" video games, according to their use/lack of rules stating the goals. A more detailed analysis of these rules can be made with the "GamePlay" bricks, to provide information about the basic rules used that shape the gameplay. A third level of analysis could be made through the use of in-depth rule analysis tools, such as the *Ludemes* (Koster 2005), the *Game Design Patterns* (Bjork & Holopainen, 2005), or the *Game Grammar* (Bura, 2006). However, these tools provide such a high level of accuracy that their results would be difficult to use in a classification. They appear more suited to an extensively detailed analysis of just a few games. The G/P/S Model therefore relies on two levels of gameplay analysis: the difference between "Game" or "Play" types and a general overview of the basic rules thanks to "GamePlay bricks".

Purpose

The purpose-based classifications presented earlier suffer from several limitations. We have observed already that some of these classifications are based on heterogeneous categories, because some of them are more related to the "market" than to the "purpose" of the game. But the boundaries of several "purpose-related" categories can also be discussed. More specifically, some categories seem to suffer from overlapping boundaries, and could be merged into a single category.

By way of example, of the four purpose classifications presented earlier, we will compare the purposes of *"Edugames" / "Games for Education" / "Learning Games"* with those of *"Advergames" / "Advert Games"*.

The purpose of *Edugames* is to transmit educational knowledge. The purpose of *Advergames* is to broadcast advertising, which can be understood as some kind of a commercial product-related knowledge. Hence, though their intentions are different (commercial or educational), these two categories of games appear to share the same "purpose" - **to broadcast a message**.

The same observation applies to other categories: *"News Games"* deliver news-related messages; *"Political Games"* deliver political messages; *"Business Games"* deal with business messages… Thus, the "purpose" of these categories is used to differentiate between the nature of the messages broadcast by the games. In order to produce a simple result, we will deal with the four "less specific" characteristics of the messages that can be broadcast by games: educative *(Edugames)*, informative *(Newsgames)*, persuasive *(Advergames, Political Games* – see Bogost 2007*)* and subjective *(Military games, Art games)*.

However, not all Serious Games are based on message delivery. Indeed, games that fall into purpose categories such as *"Training and Simulation Games"* or *"Games for Health"* are aimed at a slightly different "purpose" from communication: **training**.

For example, *Pulse!!* is used to train medical professionals on how to handle health emergency situations, while other titles such as *Mosbe* are simulators used to train soldiers for military operations. The main "purpose" of these games is not to broadcast a message but to improve the player's cognitive and/or motor skills for precise tasks or applications.

Moreover, if we look more closely at some "purpose" categories, we can observe that they actually group both "training" and "message-broadcasting" games. For example, *"Games for Health"* feature both training games such as *Pulse!!* and message-broadcasting games such as *Re-mission*. Such a "purpose" category as this, that makes no distinction between these two types of game, appears to be quite limited. In the case of a game that combines both "commercial message broadcasting" and another "purpose", for example in a "message broadcasting" or in a "training" category, we propose that it should be regarded as an *Edumarket game*.

We also propose introducing a third "purpose" category related to the **exchange of data**. At the time of writing, few examples of these Serious Games exist. *Foldit* is a Serious Game in which players must find the best way to fold proteins. The solutions thought up by the players are used to extend knowledge in the scientific research field. *Google Image Labeller* uses a similar approach to improve the image searching technology created by *Google*. Whilst these two games are dedicated to a one-way exchange, from the players to the publisher of the game, other titles are designed to simplify the exchange of information between players. For example, *Lure of the Labyrinth* is designed to support the teaching of the basics of mathematics and geometry in the classroom. The teacher sets up an online game session for the students to join and they can then solve mathematics-based puzzles by helping each other. Players are rewarded with score points for helping other players and, as a consequence students are obliged to practice their math skills to a point at which they are able to help. *PowerUP*[14] uses a similar concept to deal with ecological topics.

As a result, we propose classifying the "purpose" according to the following list. A single video game can be designed for one, several or none of these purposes:

- **Message-broadcasting:** the game is designed to broadcast a message. This message can be of several types: educative *(Edugames)*, informative *(Newsgames)*, persuasive *(Advergames)* and/or subjective *(Military games, Art games)*.

- **Training:** the game is designed to improve cognitive performance or motor skills. *Exergames* (related to brain training or fitness) are typical examples of this purpose.
- **Data exchange:** the game is designed as support for exchanging data. Games collecting information from their players or encouraging them to exchange data are examples of this purpose.

Scope

Our analysis of market-based classifications has already highlighted the main limitations of this standard: the ever-increasing number of available markets. The best approach to this standard seems to be to merge the previously identified markets into one single list, whilst leaving it possible to add new markets when necessary. For the G/P/S model, this list will contain the following items: *State & Government, Military & Defense, Healthcare, Education, Corporate, Religious, Culture & Art, Ecology, Politics, Humanitarian, Advertising, Scientific Research*. A precision with respect to the *Corporate* market: this should be used only to classify games designed to be used within a company, and not for any game that was released by a corporation. Indeed, the "market" criterion solely reflects the targeted domains that will "use" the game.

Also note that *Entertainment* should be included as a market in this list: whilst most entertainment games are used only in the entertainment market, some Serious Games are used in both entertainment and non-entertainment markets (for example, *America's Army*[15] is used both in military training courses and in gaming tournaments[16]).

However, the professional field(s) for which a game is designed is not the only example that can define the "scope" dimension of a video game. For example, a more detailed analysis of the targeted audience (age-range, type, gender, etc.) would enable the classifying of video games with more precision. These kinds of criteria were already used in "rating systems", such as ESRB (1994) and PEGI (2003), but they were designed solely for the prevention of content that shocks. We propose using a more general approach to the audience targeted by game designers. For now, we will classify the target audience from two aspects: its "age" and its "type". To classify "age" we will define several ranges *(0 to 3 years old, 4 to 7 years old, etc...)* inspired by both ESRB and PEGI rating systems. The "type" will simply differentiate between *General Public*, which refers to anybody, *Professionals* which represents workers from the targeted market, and *Students* which groups the people who are studying to join the professionals. For example, in the *Healthcare* market, *Professionals* will refer to medical practitioners, *General Public* to their patients, and *Students* to medical school students.

Summary

The plan below summarizes the G/P/S classification model on a single page. By ticking the boxes on this page, it is possible to classify a video game very rapidly:

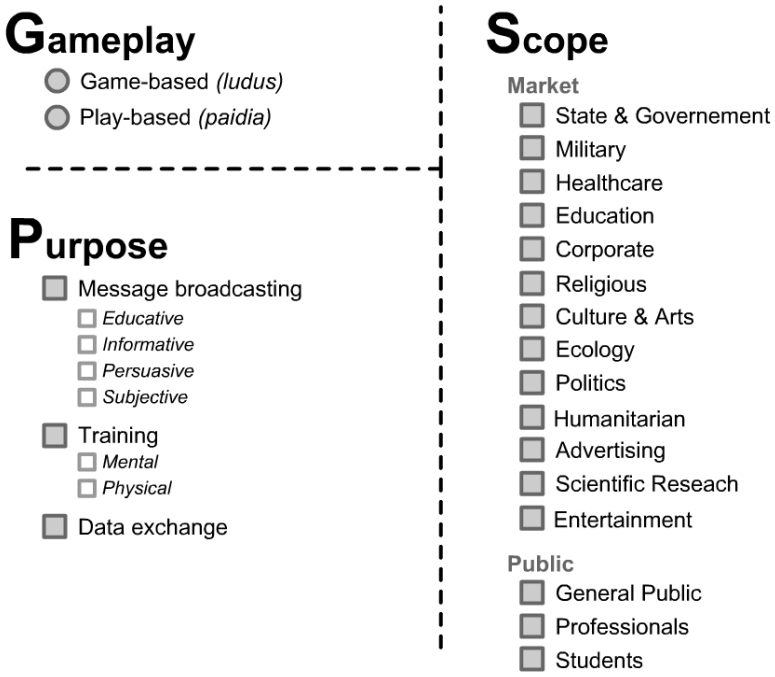


Fig 2. A "printable page" representation of the G/P/S model

USING G/P/S TO IDENTIFY GAMES FOR EDUCATION

Now that we have described this overall classification system, how can it be used in the field of Education?

As discussed in the introduction, this system is not intended to provide a detailed analysis of the cognitive skills that Serious Games support, a task that only a system sharply focused on Education could perform. The G/P/S model is intended to provide common ground with which to browse the whole field of Serious Games. Teachers are able to use it to identify games not labeled as "educational" but which, due to their "serious" purpose, may be relevant for classroom use. Using the "printable page" (fig 2.) games can be classified easily by ticking boxes. However, classifying games is a time-consuming task as is that of identifying games designed for a "serious" purpose. Therefore, to emphasize the fact that the G/P/S model can be used to discover new Serious Games, we have built a collaborative online database around it. This database assembles the classification information for a large range of Serious Games originating from a wide array of sources. At the time of writing, this tool hosts "classification pages" for 550 Serious Games. Thus teachers are now able to go to http://serious.gameclassification.com/ and use the G/P/S model to browse quickly through games designed for a serious purpose. If someone identifies a game missing from the database, its collaborative nature allows him/her to add the game reference directly and classify the game.

As an example, we provide a small selection of Serious Games chosen from this database. These games are associated with different "markets" but their "serious" content makes them potentially interesting within an educational context:

- *Lure of the Labyrinth*[17], is an educational multiplayer online game created by MIT's 'The Education Arcade' and is supported by Maryland Public Television. Designed for classroom use in middle schools, this game enables teachers to prepare "game sessions" for their students. Each student can then create an avatar to join an online adventure in a fantasy world full of puzzles. To solve these puzzles, players will have to be aware of basic mathematical concepts like proportionality, graphing, geometry, variables and rational numbers. This Serious Game also encourages writing, as players can earn points by helping teammates. Indeed, the content of the built-in help system for each play session is written solely by the students. Each player faces puzzles that are based on the same principles but with different solutions. Therefore, in order to help each other students have to write down problem-solving strategies instead of sharing answers.
    - Gameplay:
        - Type: *Game-based.*
        - Goals: *Avoid, Match.*
        - Means: *Create, Manage, Move, Select, Write.*
    - Purpose:
        - Purposes: *Educative message broadcasting, Data Exchange.*
    - Scope:
        - Markets: *Education.*
        - Target audience: *11 to 15 year olds, Students.*

- *Fatworld*[18], is a game about the politics of nutrition, released by the Corporation for Public Broadcasting (a corporation which funds public television and radio in the US). This game starts by allowing players to customize an avatar, from its appearance to its eating-related disorders (obesity, diabetes etc...). They then enter a virtual world in which they must take care of their avatar and organize its daily life. In addition to finding a job to earn money and making social contact with other avatars, the players will have to take extra care about what their avatars eat. This game illustrates the complexity of nutrition policies from the perspective of 'daily life'.
    - Gameplay:
        - Type: *Game-based.*
        - Goals: *Avoid, Match.*
        - Means: *Move, Manage, Select.*
    - Purpose:
        - Purposes: *Educative message broadcasting, Informative message broadcasting.*
    - Scope:
        - Markets: *Healthcare.*
        - Target audience: *8 to 25 year olds, General Public.*

- *Re-Mission*[19], a game about cancer released by HopeLab, a non-profit association. This game enables players to assume the role of chemotherapy, pictured as futuristic nano-soldiers. These soldiers can enter the bodies of patients and eradicate cancer by shooting drug molecules. Based on real medical cases, this game is used inside clinics to present how chemotherapy works to young patients, and also is distributed to the general public to raise their consciousness about cancer.
    - Gameplay:

        - Type: *Game-based.*
        - Goals: *Avoid, Match, Destroy.*
        - Means: *Move, Shoot.*
    - Purpose:
        - Purposes: *Educative message broadcasting, Informative message broadcasting.*
    - Scope:
        - Markets: *Healthcare.*
        - Target audience: *8 to 25 year olds, General Public.*

- *September 12th*[20], a news-related game created by video game researcher Gonzalo Frasca. This game presents the player with an unnamed village in the Middle East. The village is inhabited by a number of terrorists and many innocent people. The player is able to shoot missiles into the village, but the delay between pulling the trigger and hitting the target, and the area effect of the explosion, makes it very hard to kill a specific target. If the player kills innocent people their virtual relatives will mourn their loss and become terrorists to avenge them. This game provides no goals or judgment of a player's choices. It shows players only the consequences of their actions. This military game is a type of "interactive essay" about "military response" that was chosen by the US government after the 9/11 tragedy.
    - Gameplay:
        - Type: *Play-based.*
        - Goals: *(none).*
        - Means: *Shoot.*
    - Purpose:
        - Purposes: *Subjective message broadcasting.*
    - Scope:
        - Markets: *Politics.*
        - Target audience: *17 to more than 60 year olds, General Public.*

- *Stop Disasters!* [21], a game about natural disaster prevention released by the United Nations. This game enables players to take control of several villages that are facing imminent disaster, such as a tsunami, a giant fire or an earthquake. Players are able to build and organize preventative procedures in order to limit casualties in the best way possible. This game provides a great deal of educational information about the methods used in natural disaster prevention and shows a glimpse of the way of life of people living in different countries often threatened by disaster.
    - Gameplay:
        - Type: *Game-based.*
        - Goals: *Avoid, Match.*
        - Means: *Create, Manage, Select.*
    - Purpose:
        - Purposes: *Educative message broadcasting, Informative message broadcasting.*
    - Scope:
        - Markets: *Healthcare, Ecology, Humanitarian & Caratative*
        - Target audience: *12 to more than 60 years old, General Public.*

All these games are freely distributed on the Internet, and whilst they address different issues, they all fit into the definition of Serious Games as discussed at the beginning of this chapter. For the G/P/S model,

video games that are designed solely for entertainment will be characterized by a lack of any qualification within the "purpose" criterion and *"Entertainment"* will be the only targeted market within the "Scope" criterion. According to our definition, a video game classified with any other "purpose" and "market" can be considered as a "Serious Game".

Of these example games from the G/P/S database, none was designed for the "Education" market, with the exception of *Lure of the Labyrinth*. However, some of them were designed to broadcast an educational or informative message, and that gives them some potential for being used as teaching material. Serious Games that lack such an educational dimension yet that broadcast a subjective message, such as *September 12th*, can also be of interest if used in the classroom. In such cases, the teacher should be fully aware of the "subjective" nature of the game and this particular aspect should be drawn to the attention of the student. So again, the use of the G/P/S model and its database can help teachers to make a selection of Serious Games for educational use.

CONCLUSION

At first the wide variation of Serious Games may be confusing. With the aim of introducing some order into this confusion, there exist a number of bids to develop a system of classification. The Serious Games medium brings together participants with many different perspectives and from many differing fields such as communication, simulation, training etc. Yet, despite all these differences, they appear to agree on the basic components of Serious Games: having a "serious" dimension combined with a "game" dimension.

According to this definition therefore, it is surprising to observe that all currently available classifications of Serious Games are focused solely on the "serious" side. In parallel with these classifications, were a larger set of classifications created for entertainment games, but they focus only on the "game" side and disregard any purpose other than entertainment. A review of both types of systems reveals that they are "incomplete", as they both provide equally relevant but very different information.

Considering the dual nature of Serious Games, we propose the introduction of a system that classifies Serious Games according to both the "serious" and the "game" dimensions. The G/P/S model defines a set of criteria that encapsulates these aspects of Serious Games: Gameplay (for the "game" side), and Scope+Purpose (for the "serious" side). These criteria are presented on printable pages with checkboxes to enable a rapid classification of games. However, to guide teachers through the vast field of Serious Games, the system is also embedded in an online database of Serious Games. Here, the G/P/S model provides a general overview of how each game is played and for what purpose it is designed. Using this information, teachers can browse quickly through a vast array of Serious Games in order to choose those that are relevant to their teaching. For example, in games dealing with ecology, different gameplay (shooting, management...) and purposes (information, training...) are available. It is the ability to differentiate and identify games quickly, compared with previous classifications, that is the main improvement that the G/P/S model provides.

However, as with any classification system, the G/P/S model does have certain limitations. As a classification model designed intentionally to provide a general overview, the system is not able to provide detailed information concerning a specific area of the Serious Games field. For example, for games associated with the Education market, the classification is unable to differentiate between those dealing with mathematics and those with linguistics. It can only differentiate between games according to the criteria shared by all application domains of Serious Games. However, as stated before, it can assist

teachers to discover those Serious Games not designed for the Educational market, but interesting for classroom use. The system can also help to identify those video games designed for entertainment that can be "shifted", to serve an educational purpose. Such "purpose-shifting" of entertainment games is an extremely promising method of using games as teaching tools. We call it "Serious Gaming".

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NOTES

[1] http://www.gameclassification.com/EN/games/1248-Trauma-Center-Under-the-knife/index.html
[2] http://serious.gameclassification.com/EN/games/1017-Pulse/index.html
[3] http://www.gameclassification.com/EN/games/3206-Ico/index.html
[4] http://serious.gameclassification.com/EN/games/1222-Escape-From-Woomera/index.html
[5] http://gameclassification.com/EN/games/1223-Half-Life/index.html
[6] Personal translation from French: "*sensibiliser, simuler, former, informer, éduquer et influencer*".
[7] A common example is the definition of the "simulation" category. A game like "Gran Turismo" might either be considered as "simulation" or not, depending on the player who classify it.
[8] Some classifications will dig deeper into details than others. For example, the "shoot'em up" category can be used as is, can be merged into a larger "action" category, or can be divided in several "sub-genres" such as "run n' gun", "manic shooter", "cute them up", etc.
[9] Personal translation from French: "*un ensemble de règles, des modes de commandes, l'organisation spatiale, l'organisation temporelle, l'organisation dramaturgique*".
[10] Ludology is an interdisciplinary academic field dedicated to the study of games. See Frasca (2003) for more details.
[11] http://www.gameclassification.com/EN/games/580-Sim-City/index.html
[12] http://www.gameclassification.com/EN/games/501-Pac-Man/index.html
[13] http://www.gameclassification.com/EN/games/597-Space-Invaders/index.html
[14] http://serious.gameclassification.com/EN/games/12111-PowerUp/index.html

[15] http://serious.gameclassification.com/EN/games/758-Americas-Army/index.html
[16] More information on e-sports tournament related to America's Army: http://www.gotfrag.com/aa/
[17] http://serious.gameclassification.com/EN/games/11511-Lure-of-The-Labyrinth/index.html
[18] http://serious.gameclassification.com/EN/games/1018-Fatworld/index.html
[19] http://serious.gameclassification.com/EN/games/1041-Re-Mission/index.html
[20] http://serious.gameclassification.com/EN/games/734-September-the-12th/index.html
[21] http://serious.gameclassification.com/EN/games/1334-Stop-Disasters/index.html