Exploring the value of genres in serious games

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ABSTRACT

The choice of a particular genre in serious game design often seems ad hoc or motivated by gamers' preference or pure pragmatic issues such as choice of platform. Although these are probably valid and justified reasons, an inconsiderable choice of game genre might contribute to a failure of conveying the learning content and, in addition, lead to a decrease in game enjoyment. Indeed, there might be a link between a specific learning content and the 'best' possible game genre to approach this content. With the analysis of four game examples with different genres and in different fields, we want to explore the appropriateness of game genres for learning contents, and point to the need for further research in order to improve learning outcomes as well as gaming experience.

Author Keywords
Serious game; game genre; learning content.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION: GENRE AND LEARNING CONTENT
During the last decade, an increasing number of serious games have been designed, related to a wide range of fields. Consequently, a number of classifications of serious games have been proposed, most of which are related to either the market where the games are released (e.g. healthcare, as in [1]), to the purpose of their development (e.g. exergames, as in [3]), or to a combination of these (e.g. [12]). However, these taxonomies suffer from a major limitation of their scope [7]: none of them classifies 'serious games' as 'games'. Indeed, none of these systems provide relevant information about the game structure, gameplay, or the game *genre* it classifies. In popular readings, the genre of a serious game is sometimes even just referred to as 'serious game'.

Meanwhile, many actual serious game designs of course represent one or more particular game genre or game style. However, in game design case studies the motivation of the

choice for a particular game genre is either not provided, or it is based on pragmatic considerations (e.g. the choice of platform, which has an influence on the choice of genre), or the genre preference of the target players group, which is correlated with a number of variables, such as personality type [10] and the player's learning style [5]. The choice of genre is thus mostly related to individual characteristics of the gamer, and these have been studied extensively. In contrast, few serious game studies base their choice of genre on the learning content at hand. According to Prensky [11], "Practice works. But of course you must be practicing the right things, so design is important." Indeed, there are many kinds of learning content, and these types of content require different methodologies [11]. Various game genres or styles probably have specific characteristics that are best suited to convey specific learning messages. Prensky suggests a number of possible game styles suited for each type of learning content [11]. However, to our knowledge, the appropriateness of various combinations of learning content and game genre hasn't been explicitly put to an empirical test. With this paper, we want to start exploring this research topic with the analysis of learning content and genre of four game examples.

EXAMPLE ANALYSIS: ONE CONTENT, ONE GENRE?
For our analysis, we made use of learning content and activities concepts as described by Prensky [11]. Whatever the particular subject, Prensky distinguishes various kinds of learning content, such as learning knowledge or facts, skills, judgments, behaviours, reasoning, etc. He further distinguishes a number of learning activities, used to convey the learning content at hand. For example, memorization is a learning activity that can be used to learn facts, whereas the presentation of problems and examples can be used to learn abstract reasoning.

Based on Prensky's model, we chose two divergent learning contents for our analysis: healthy nutrition and computer programming. Acquiring a healthy food plan requires learning facts on the one hand, and a behaviou0r change on the other hand. To accomplish this, learning activities such as questions, memorization, association, drill, imitation, feedback and coaching are needed [11]. Learning how to program requires abstract reasoning, which is mostly approached by learning activities such as presenting problems, and showing examples [11]. Since these learning contents obviously require very different learning activities, they allowed us to explore and highlight

the interaction of different game genres with differing learning contents.

For each learning content, we searched two games with a different genre. For the health education topic, we analyzed a puzzle game and a simulation game. For the programming topic, we examined a puzzle game and a strategy/adventure game. This way, we wanted to explore how (a) different genres convey the same learning topic, and (b) how one genre (puzzle) is applied to two totally different learning topics. We hereby adopted the following notion of game genre, as proposed by Apperley [2] and Wolf [13]: game genre is a categorization of games according to their gameplay interaction; a game genre is thus defined by a set of gameplay challenges, e.g. action games have gameplay with emphasis on combat; strategy games focus on gameplay requiring skillful thinking and planning, etc.

In summary, we explored the appropriateness of specific game genres for passing on specific learning contents. For this analysis, we made use of a terminology of learning content and learning activities also described by Prensky [11]. From our analysis, we drew up a list of striking issues related to the possible relevance of matching learning content with the most appropriate game genre.

The games
NutriChef (NC) [8] is an interactive Wii game that **simulates** real life interactions with food. Children are required to virtually plan and prepare nutritionally balanced meals. They hereby have help from a 'teacher' character that introduces basic concepts and methods, and gives hints whenever they experience problems. The teacher thus models the desired learning task and gradually shifts responsibility to the student (Figure 1). The desired learning outcome of this game is knowledge of the different food groups, and, eventually, acquiring a healthy food plan.

Nutrition 4 kids (N4K) [9] is a group of nutrition games. One of the games, Food Drop, is a **puzzle** game, presenting, per level, a grid filled with foods of the same food groups. The goal is to swap foods to get three or more foods of the same kind (i.e. three bowls of cereal) in one row. Another game, Food Detective, is a **memory matching** game, where pictures of foods have to be paired with their food group (Figure 2). The desired learning outcome of these games is knowledge of the different food groups.

Cargo-Bot (CaB) [4] is a **puzzle** game where a robot has to be taught how to move cranes. A picture of the end goal is presented, and the player disposes of a toolbox filled with symbolic representations of programming concepts to puzzle a set of instructions for the robot in order to reach the end goal (Figure 3). The learning objective of this game is to understand basic programming structures.

Colobot (CoB) [6] is a real time **strategy** and **adventure** game. The player is the head of a space expedition, and is assisted by robots. The mission consists in exploring and colonizing various planets. The player has to search for materials and energy in order to survive, and can be attacked by primitive life forms that have to be fought in order to survive. The player can build and program new types of robots to help him complete his task (Figure 4). The learning objective of this game is to understand basic programming structures.

Figure 1. NutriChef - Genre = simulation – Learning objective = knowledge of food groups.

Figure 2. Nutrition 4 kids - Genre = puzzle – Learning objective = knowledge of food groups.

Figure 3. Cargo-Bot - Genre = puzzle – Learning objective = understanding basic programming structures.
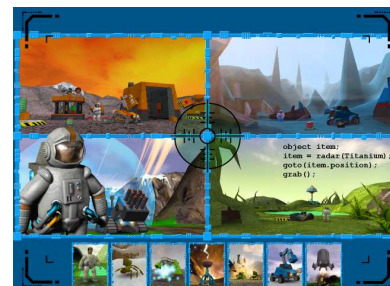

Figure 4. Colobot - Genre = strategy/adventure – Learning objective = understanding basic programming structures.

Analysis
Table 1 presents an overview of our analysis. Learning content and associated learning activities according to

Prensky [6] are shown on top of the table. For example, health education requires learning facts and behaviours, through learning activities such as memorization and practice respectively; computer programming requires reasoning, through learning activities such as presenting problems and examples. Next (see Table 1), for each game and game genre, two types of combinations are presented: (1) whether a particular learning activity is required or useful to teach the particular learning content of the game (e.g. in a serious game for health education, the learning contents are facts and behaviours, and thus associated learning activities are useful here); and (2) whether a particular learning activity is naturally provided by a specific genre (e.g. one of the typical characteristics of a puzzle is that it presents problems). For example, rows 1 and 2 (bold row numbers indicated in Table 1) present the learning activities that might be useful or required to convey the learning content of health education games; row 5 shows that the simulation game genre provides two learning activities (imitation and feedback) relevant to learning a behaviour change, which is essential to acquire healthy eating habits.

Learning content and activities									
Facts				**Behaviours**				**Reasoning**	
questions	memorization	association	drill	imitation	feedback	coaching	practice	problems	examples
(1) Learning activity useful to convey learning content: health education and programming									
HEALTH **1** NC: x	x	x	x	x	x	x	x		
2 N4K: x	x	x	x	x	x	x	x		
PROGRAMMING **3** CaB:								x	x
4 CoB:								x	x
(2) Learning activity provided by genre: simulation, puzzle and strategy/adventure									
SIMULATION **5** NC:				x	x				
PUZZLE **6** N4K:	x	x	x					x	x
7 CaB:	x	x	x					x	x
STRATEGY **8** CoB:				x	x				
questions	memorization	association	drill	imitation	feedback	coaching	practice	problems	examples
Facts				**Behaviours**				**Reasoning**	
Learning content and activities									

Table 1. Analysis of combinations of learning contents (health education and computer programming) and game genres (simulation, puzzle, strategy/adventure) . NC=NutriChef – N4K=Nutrition4kids – CaB=Cargo-Bot – CoB=ColoBot.

This analysis led us to the following reflections:

▪ A learning content is sometimes approached with different game genres, while these genres not always provide the necessary learning activities. NC and N4K have the same learning content *(rows 1-2* in Table 1*)*, but by making use of different genres (simulation versus puzzle), this content is approached differently, and through different learning activities *(rows 5-6)*. NC's genre is, at first sight, more appropriate than N4K since it makes use of the learning activities required by the learning content.

▪ Two totally different learning contents are sometimes approached through the same game genre *(rows 6-7)*, while these learning contents require a totally different set of learning activities *(rows 2-3)*. Both N4K (health) and Cargo-Bot (programming) make use of puzzles. While this genre is tightly linked to the learning content in Cargo-Bot, it is not in N4K. The consequence, in N4K, is that the intended learning content is only integrated into the game through a repetitive presentation of pictures of healthy food, and via textual information.

▪ Each genre has specific characteristics that are sometimes naturally linked to a particular learning activity. In

Colobot, the player has the opportunity to program robots, but this is not necessary to play the adventure game. The main genre of this game does not deliver the learning activities required to learn how to program. Instead, adventure games provide learning activities such as feedback and coaching (*row 8*), but these are not explicitly used to teach how to program here. The adventure parts of the game appear to be solely used to add playful elements to the serious purpose of the game.

▪ Some learning activities that are required to teach a particular learning content, but that are not provided through the game genre, are often provided through the presentation of plain text information within the game. For example, information about nutrition cannot be presented through a puzzle, so each level in N4K is preceded by a textual description of the nutritional value of food items used in the puzzles.

▪ Some learning topics (e.g. programming) appear to represent a type of learning content that is so specific that it can only be effectively conveyed through one specific approach. Cargo-Bot is in fact nothing but a 'visual puzzle shell' on top of a set of programming instructions: playing the game *is* programming. Other learning contents, such as health education, are broader topics, and cover a wider range of learning activities. They can be approached with a larger choice of genres. However, few of these genres seem to be able to provide all learning activities required for these learning contents. For example, changing nutrition behavior is known to be very difficult to attain: it requires a considerable change of attitude and habits. As long as a game only delivers part of the learning activities, such as learning the facts about healthy food but not the necessary attitude change, the game's genre becomes irrelevant.

▪ From playing the games, it became clear that the most fun parts were the ones where (a) the *game in itself*, regardless learning content, was fun to do (e.g. in N4K, where the puzzle genre had nothing to do with the learning content), and (b) the *successful learning experience* was fun to do (e.g. in Cargo-Bot, where the puzzle genre is closely linked to the learning content). It might be that matching the genre to the learning content improves the learning process. A smooth and successful learning process, in its turn, might improve the playing experience.

DISCUSSION AND FUTURE WORK

In this paper, we made a critical and analytical review of four example games. We based our analysis on a categorization of learning content/activities documented by Prensky [11]. Based on our expert reading of the games, we are inclined to say that a 'best genre' for a particular learning content exists, and that game genre should thus be defined in function of the learning content. In addition, we believe that this will improve the learning process, which, in its turn, will enhance the fun experience of the game and prevent game failure. However, these are only broadly formulated hypotheses. Indeed, the main purpose of this paper was to point out the difference in appropriateness of game genres to convey particular learning content, and, therefore, a need for further systematic empirical research.

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