Guidelines for Development of Edutainment Video Games

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Abstract – Learning through play is an effective and attractive educational strategy, especially with younger students. Edutainment media is a teaching tool that aims to teach while simultaneously amusing the students. Edutainment content followed the invention of every new type of multimedia, including video games (EVG) and has been used as an auxiliary teaching tool ever since. However, it could be argued that the entertainment aspect was often overlooked, leading to a negative reputation for edutainment content in general. Analysis of existing edutainment media can be used to form guidelines that would prevent future content from falling into the same pitfalls and amuse, as well as educate.

I. EDUTAINMENT

Edutainment arguably predates the inception of multimedia, with learning through play as a concept being observed in prehistoric humans as well as in the animal kingdom [1]. The word "edutainment" itself has been officially coined relatively recently with the earliest documented use dating back to Walt Disney in 1954[2].

Edutainment encompasses media designed to possess the allure of entertainment while attempting to convey educational content. Since the early 1990s there was a surge in edutainment-centric video games. EVG titles have since been successfully used for teaching children mathematics, geography, history, etc. for decades, and some of them have grown into multi-million dollar franchises [3].

A. Edutainment Target Audience

Primarily aimed at children, EVGs focus on learning through exploratory activities, not traditional school-based teaching methods that often fail to make learning fun [4]. Stated objectives in edutainment often have very little to do with the actual objectives since activities driven by exploration, discovery and adventure in an interactive environment are more appealing to children than learning in a formal classroom setting[5].

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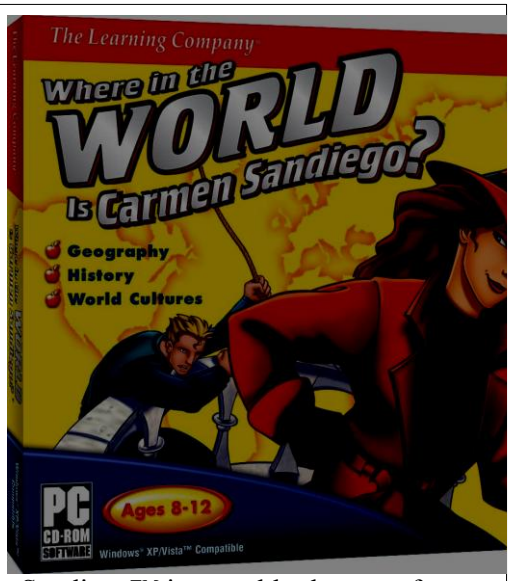

Figure 1. Carmen Sandiego™ is arguably the most famous edutainment multimedia franchise.

B. Questionable EVG quality

Some EVGs arguably fail to either motivate or educated the players [6], with Karl Royle stating that "Such efforts have failed either because games designed to educate do not engage their intended audience, or because truly engaging games do not provide enough educational value"[7].

One major issue of current approaches is the lack of design rules to ensure their effectiveness, which have found challenges with using leisure games effectively in learning contexts, particularly in terms of setting and assessing specified learning objectives. Attempts at a bait-and-switch approach may initially get the players' attention, but it almost guaranteed that they will not only quickly loose interest, but also be put off from playing the game, again [8].

Differences in teaching approaches between different age groups are often ignored in EVGs, as players' demands grow along with them [9]. Certain teaching methods are also not equally effective across different age groups [10].

Some EVGs also decide on a genre inappropriate for the game's subject matter [11].

Analyzing existing edutainment content does show certain trends that could be used to form guidelines to avoid common pitfalls in the future [12].

II. METHODS OF LEARNING

Children learn the most easily through observation [13] or cognitive osmosis, meaning that they'll make a conclusion about the rules that apply in a given context from a series of presented situations. EVGs allow players to infer what rules apply within the world of the game based on the actions they took within situations they found themselves in.

A. General Learning Model in EVGs

General learning model (GLM) attempts to explain the relationship between exposure to media and the internal processes that form long term cognitive attitudes.

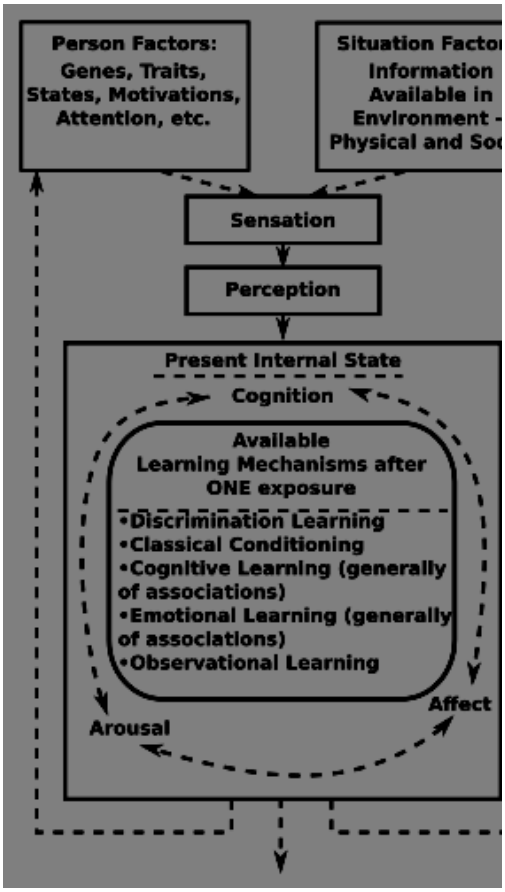

Figure 2. General Learning Model flowchart

An important aspect of GLM is that it takes into consideration learning on multiple levels of consciousness.

There are three basic reactions in the brain during gameplay [14]:

- The received visual, audible and other stimuli are processed instinctively and emotionally.
- The stimuli are compared to memories of previous experiences.
- The frontal cortex will be activated and an attempt will be made to logically explain to the player what happened based on the previous two reactions.

Short term memory is formed based on those three steps of observations. Long term memory is formed through repetition of the situation that forms the short term memory through trial and error. Finally, the brain gradually shapes long term memories into applicable knowledge.

Repeated stimulation of the same brain structure can cause conditioned responses to form.

Association is important because if players notice two or more concepts simultaneously and repeatedly, they will consider them connected in some way, even if they can't explain exactly how [15].

B. Learning Through Observation

The players start off observing other people's behavior and not knowing exactly how specific tasks are done [16]. The observer then takes over the command and starts actually playing the game.

Depending on the players' previous level of experience, the first few seconds or minutes of the game can draw them into the game, or make them completely loose interest in it.

EVGs' primary advantage over other forms of edutainment multimedia is that they provide immediate feedback to the players depending on their actions [17].

Edutainment is rarely a replacement for classical learning, but it can nevertheless be a very useful tool for getting younger children interested in subjects they would otherwise avoid, as well as for instilling prior knowledge for classical future teaching [18].

III. GAMEDEV GUIDELINES

A. Video Games in General

Most general video game development (gamedev) guidelines apply to EVGs. Some of the relevant factors include:

- Bushnell's law that states "All the best games are easy to learn and difficult to master" applies to the entertaining aspect of the EVG's gameplay mechanics [19].
- Player's reactions to success and failure can differ greatly depending on whether they're depicted realistically or comically stylized. Realism should be avoided in certain situations, especially if the game is trying to

get the players to think and act in a way they're not accustomed to [20].

- Graphics influence the players' experience and the amount of risk they're willing to take. The more abstract they are, the more risk the player is willing to take [21].
- The game's narrative has to be immersive in order to keep players' attention [8].
- A threat from a villain, whether it be humanoid, or abstract is important for initially getting the player's attention [22].
- The goal of the game should be clearly defined and ultimately simple [23].
- The player will feel certain negative emotions after making a mistake, more so if it's effects are irreversible, and especially if they perceive the mistake as the game's fault and not their own [24].
- If the players' actions lead to them advancing through the game, they will feel positive emotions, unless they consider the positive result was achieved too easily [24].
- Whether the game is single player or multiplayer also influences the players decision making. Peer pressure is an important factor [25].

B. EVG Specific Guidelines

- The game's genre should be pertinent to the subject it is supposed to be teaching, if possible [26].
- If aimed at younger players, the game's graphics and sound design should be child friendly. Symbolic 2D graphics are preferable, except in specific cases where orientation in 3D space in an integral part of the subject matter [27].
- Goals the game expects the player to achieve must be appealing to the target demographic and age group [24].
- Interface, gameplay mechanics, as well as difficulty levels should be age appropriate [24].
- Implementation of reward and punishment system discussed in chapter II is relatively easy in EVGs, with actions the developers wanted the player to take being rewarded, and actions the developers did not want them to take being punished.
- Educational aspect should be indirect and possibly subconscious. If players notice sudden interruption of the gameplay abruptly stops so the educational aspect can be focused on, they will feel frustration and possibly loose interest in playing the game any further [28].
- Educational aspect must not overshadow the entertaining aspect of the game, otherwise the player will loose interest in playing the game [12].
- Knowledge transfer in EVGs can be relatively quick and easy, while application of knowledge gained through such means takes a certain period of time to adapt [24].

Figure 1. The Sims™ is not classified as an edutainment title, but it does possess certain characteristics of the genre.

C. EVGs and Simulations

Simulations, while usually considered a separate genre often overlap with edutainment as well as video games made purely for the purposes of entertainment. While titles like The Sims™ are not advertised as educational per se, it has been observed that they teach the players' skills like multi-tasking, architecture, design, etc [29].

Educational potential of games not specifically designed to educate remains largely unexplored [30].

IV. CONCLUSION

Over a century of research has shown that there isn't enough conclusive evidence that knowledge learned through play can be applied in the real world without additional classical teaching and training. Edutainment, however, still remains a powerful auxiliary teaching tool that can make classical teaching methods easier and more effective [14].

Long term results can only be ascertained when the students learn about the subject matter in a more classical fashion, especially if their results are compared to those of students who weren't provided with edutainment content earlier in life. Nevertheless, some immediate positive effects edutainment has had in areas where there is trouble garnering the students' interest in a particular subject and imparting some

basic knowledge of it have been demonstrated by several studies[6].

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