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Improving player experience in Computer Games by using players' behavior analysis and linguistic descriptions

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ABSTRACT

Understanding player behavior has an interest to computer games researchers and developers since it allows them to improve the design and implementation of computer games and also to ensure that players have the expected experiences. Currently this knowledge is not usually reported to players as feedback, although sometimes it is already used as an analysis tool. This paper presents a novel technology for automatically generating linguistic reports and immediate feedback from actions performed by players during play sessions. These reports allow developers to provide players with a more complete and personalized feedback about their behaviors, abilities, attitudes, skills or movements. In order to show and explore the possibilities of this new technology, we have incorporated it in the core of a computer game. We have evaluated positively that the incorporation of this kind of feedback into the core of YADY computer game allows us to improve the overall player experience.

1. Introduction

Computer games are consolidated as one of the most important entertainment items for people (Graham, 2009). They are designed for creating immersive and pleasurable experiences, which can stimulate cognitive and emotional processing (Mandryk and Atkins, 2007; Nacke and Drachen, 2011). Additionally, they are used as new and powerful platforms for teaching and learning. An important component of any computer game is the user interface. Current user interfaces provide players with some feedback about their current play sessions, e.g., "points", "coins", "pills", "dead ends", "amount of life", "speedometer" or "blood splashing". This feedback is used for improving the motivation, training, learning and immersion of players.

Nowadays, feedback is also an important feature of games and serious computer games as they provide learners with useful and immediate information about the player performance (Burgos et al., 2007; Hamilton, 2009). Therefore, a more complete feedback should provide players with more immediate and complete knowledge about their way of playing, main errors, attitudes or behaviors, than the current approaches.

The type of feedback provided by classical computer[1] games was very poor due to their limited graphical capabilities and computational power. Classical Skill games (*"Tennis for Two"-1958, "Space war!"-1961, "Pong"-1972, "Space Invaders"-1978, "Pac-Man"-1980*) include scores (level or experience points) and other added features as display counters for amount of life, levels or time. After that, games brought storytelling into games ("Colossal Cave Adventure"-1975) and put story elements (small pieces of text) and graphics together in the same game (*"Donkey Kong"-1981, "Super Mario Bros"-1985, "Final Fantasy"'-1987*). Next, 3D graphics made possible the idea of a first-person point-of-view (Poh). This kind of games often has a head-up display (HUD) for providing player with feedback, e.g., character's speed (*"SuperTuxKart"-2012*), remaining health (*"GoldenEye 007"'-2010*) or radiation levels (*"Half-Life"'-2013*). Music-theme action video games as ("Guitar Hero") provides with a *"Rock Meter"* which shows how well the player is playing (denoted by red, yellow, and green sections).

More recently, some feedback elements have been considered in order to enhance the narrative experience for the players, providing a more immersive and integrated experience mechanisms (Fagerholt and Lorentzon, 2009). For example, the game *"Metro 2033"* provides players with a virtual watch which is used to measure how long the filter in the gas mask will last and how visible he is; *"Assassin's Creed"* uses a kind of eagle vision to highlight enemies and their patrol track; *"Call of Duty"* employs Blood splashing on the screen within the 2D HUD plane to tell the player that the character is losing health; *"Grand Theft Auto 4"* allows players the interaction with a phone; *"Need for Speed: Hot Pursuit"* uses a speedometer in the 2D HUD in order to know what

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[1] The following description is not an exhaustive one, we do not try to perform a complete survey feedback, but just showing the most important mechanisms provided by current computer games.

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speed the car is traveling; *"Splinter Cell Conviction"* also adopts projections that illustrate objectives within the game world. Some texts and comments are overlaid into the environment to communicate messages to the players rather than the main character; *"Fable 3"* is another example where feedback elements are used to provide more information to the players and prevent them from jumping to a map screen. It guides the player to the next objective. The sparkling trail allows the player to guide the character; *"World of Warcraft"* uses a 2D hub showing players names in the world's geometry; *"Mass Effect 3"* uses many elements in order to inform the player of the character's selected weapon and power.

Additionally, current computer games provide researchers and designers with feedback about players' behavior by using data analysis techniques (Kim et al., 2008; Lewis and Wardrip-Fruin, 2010; Weber and Mateas, 2009). This feedback is used for improving the design and implementation of computer games since it provides them with relevant knowledge about play sessions and with a better understanding of player behavior at different levels. In Dixit and Youngblood (2008) data are collected about where users' attention was focused during gameplay. The objective is to identify the best places to put relevant information; in Kim et al. (2008) data are collected to obtain a survey of opinions on difficulty; in Weber and Mateas (2009) data mining techniques are employed in order to understand player strategies and to improve the artificial intelligence techniques in the game *"StarGraft"*; in Miller and Crowcroft (2009); Lewis and Wardrip-Fruin (2010) the movements and traces of players are analyzed on the game *"World of Warcraft"* in order to obtain a better understanding of player behavior. In *"Hitman: Blood Money"* the designer can consult statistics about players (how many shots had been fired and by which weapon, which role was most frequently used, level of accuracy, the number of police, security, civilians killed or injured, and if there were any witnesses) (Canossa, 2009). This information is also summarized in a narrative form for players by means of virtual newspapers articles. This technique has been incorporated as an analysis tool of player's behavior in others computer games such as *"Tomb Raider", "Underworld" or "Battestations: Pacific and Championship Manager"* (Canossa, 2009).

1.1. Feedback based on Grice's principles

The feedback presented in the previous section can be interpreted as a communication act, hence we can adopt the conversational maxims proposed by Grice (1991): (1) Maxim of Quantity ("make your contribution as informative as required for the current purposes of the exchange. Do not make your contribution more informative than is required"); (2) Maxim of Quality ("Do not say what you believe to be false. Do not say that for which you lack adequate evidence"); (3) Maxim of Relation ("be relevant"); (4) Maxim of Manner ("clarity"). Additionally, we take into account the features proposed by other authors (Desurvire et al., 2004; JJohnson and Wiles, 2003; Federoff, 2002; Lazzaro, 2004; Pagulayan et al., 2002; Prensky, 2001; Sweetser and Wyeth, 2005; Wiggins, 2012) by linking them with the maxims of Paul Grice wherever possible. In particular, we propose a new kind of feedback which must have the following features:

1. *Timely*: Players must receive appropriate and immediate feedback at appropriate times (Desurvire et al., 2004; JJohnson and Wiles, 2003; Sweetser and Wyeth, 2005).
2. *Goal-referenced*: Players receive frequent information on the distance and progress towards sub-objectives and goals (Lazzaro, 2004; Pagulayan et al., 2002) and about if and how they are moving in the right direction (Wiggins, 2012). Goal-referenced is related with the maxims of Quality and Relation since feedback must deliver information about how a player is moving and if he/she is doing it in a correct way. The feedback provided by current computer games is not always goal-referenced because although players receive frequent information on distance and progress towards sub-objectives and goals (they usually are Spatial elements), they do not always receive information about if they are moving correctly towards sub-objectives or how they could improve their skills in order to reach such sub-objectives in a better way.
3. Actionable: An effective feedback must be concrete, specific, and useful; it must provide actionable information. Thus, "Well done!", and "You lose!" are not effective feedback. We need to enhance this information with what specifically a player should do next time (Wiggins, 2012). Actionable is related with the maxims of Quality and Quantity since feedback must be useful, concrete and specific. Current computer games deliver limited actionable information, e.g., messages as "Well done" or "You did that wrong". Feedback delivers reduced information about players' behavior, attitudes or recommendations about ways of playing.
4. Informative: Games should use scores to tell players where they are and give positive feedback that encourages mastery of the game (Federoff, 2002). Current feedback is informative but it is not concerned with all the aspects and parts of the specific play session.
5. User-friendly: Visual and sound interfaces should be used to deliver necessary status feedback in an easy and understandable way (Pagulayan et al., 2002; Federoff, 2002). User-friendly is related with the Maxim of Manner since feedback must be clear and easy to understand.
6. Adaptability: Here adaptability is understood as the ability of a computer game to adapt its feedback to the circumstances of a particular player. Adaptability is not needed for all kinds of computer games. However, a type of feedback that allows us to provide players with information about their behavior and performance can be improved by adaptability. For example, if we detect that a player is a beginner one then we should adapt the feedback to him, e.g., by incrementing the recommendations or help messages. Feedback must allow a better adaptability which is a key feature to keep players in "flow" state (Prensky, 2001) (see Section 2). Current feedback is not always adaptable, usually it is the same for all users. It does not depend on their actions, but on statistical aspects.

As we have shown, most commercial games provide quite extensive feedback that satisfies some of the Grice's principles. However, many times this feedback is not enough when the objective is to deliver actually effective and complete feedback about player behavior and performance.

On the other hand, feedback provided by data analysis tools is employed by designers or researchers at testing and post-production phases but usually is not delivered to the players during play sessions.

In this paper we address these limitations by proposing a novel technology specialized for computer games which is based on monitoring and analyzing the actions of actors (players and agents) in game worlds.

We propose an architecture for automatically generating "play session highlights" from events occurred during play sessions between different actors by remarking the most relevant features and hiding the irrelevant ones. The main components of this architecture (see Fig. 1) are, namely, monitoring process for capturing the data (events performed by players or agents), gameplay metrics for establishing a relationship among the actors from the game world and the module feedback for recognizing player behavior. Final and immediate feedback report modules provide players, designers and researchers with automatic and more