METHODS AND APPARATUS FOR MANAGING SCORES

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1 Field

The invention relates to scoring systems, more particularly to managing the scoring of games.

2 Background

Problems associated with games:

- a player may become bored if he gets the same score every time.
- even if the mean score for all players is acceptable, poor players may become discouraged if they get lower scores while good players get higher scores (i.e., different players may have different means).

Poor players may become discouraged:

- Lots of players enjoy playing video games to win prizes.
- However, in traditional prize games, it is inevitable that some players play poorly and do not win as many prizes.
- These poor players may become discouraged, depressed, or even angry that they are not able to win prizes like they want to.

Unhappy players are bad for a gaming website:

- unhappy players may stop playing games, possibly reducing revenues for the website.
- unhappy players may complain to their friends and convince their friends to stop playing games

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- unhappy players may call customer service to complain, increasing costs for the website.

Merchants who sell prizes may lose revenues also:

- A gaming website may also sell prizes to players in exchange for points won by playing video games.
- These prizes may be supplied by merchants or other third parties.
- If players do not earn enough points to purchase prizes, then the merchants will not be able to make money by selling prizes to players.

3 Summary

According to one embodiment, the invention provides a method of calculating the variance in prizes in a video game and then modifying the video game based on this variance in prizes. For example, the controller may be a web server that hosts a website in which players may log on and play games of skill to win prizes.

As players play games on the website, the controller may monitor the games played to determine a variance in prizes awarded by the games. If the variance in prizes awarded is too high, this may be discouraging to players, since expert players may win large prizes while novice players win almost nothing. Similarly, if the variance in prizes is too low, players may become bored because there is not enough variation in the prizes awarded. If the controller determines that the variance in prizes for a game is too high or too low, then it may modify the game to alleviate this problem.

According to one embodiment, the controller may modify a video game to increase or decrease a variance in prizes awarded by the video game. This modification may be performed, for example, by changing one or more game parameters that ultimately affect what prizes are awarded by the video game. For example, the game Meteorites may have a variance that is too high. The controller may then modify the number of lives, spaceship speed, and meteorite size in the video game to reduce the variance in scores in the Meteorites game. The success of this modification may then be verified by allowing additional players to play the modified version of the game and observing their success.

Ultimately, the invention will allow an operator of the controller to manage a variance in prizes awarded by one or more video games, thereby providing a more satisfying entertainment experience for players.

4 Benefits

Benefits to players:

- players will not become bored because they always get the same score in a video game
- players will not become discouraged, depressed, or even angry that they are not able to win prizes like they want to.
- players will enjoy playing games and winning prizes

Benefits to the gaming website and merchants who sell prizes through the gaming website:

- The method of the invention provides a simple, straightforward, and quick way of modifying games to make them enjoyable to players.
- Happier players will result in increased revenues for the game provider.

5 Definitions

controller – a device that implements the method of the invention. Note that term "controller" is used interchangeably with "a party who operates the controller" (e.g., for payments that may be received by the controller or through some other representative of the party who operates the controller). See Section 7.1 for details.

player – at least one party that operates a player device to play a video game.

player device – a device (e.g., a personal computer) that may be operated by a player to play a video game. See Section 7.2 for details.

video game – an electronic game that takes at least one input from a player and displays game results to the player. See Section 8.1 for details.

game – see video game

entry fee – consideration that is provided by a player in order to play a video game. See Section 8.1.1 for details.

payment identifier – (e.g., credit card number) information that is useful in obtaining consideration from a player.

prize – consideration that is provided to a player based on a result of at least one video game. Examples of prizes include currency (e.g., money, points), products, services. According to one embodiment, a player may win a currency for playing at least one video game and then use this currency to purchase a prize. See Section 8.1.3 for details.

currency – "something...that is in circulation as a medium of exchange" In this disclosure, the term currency includes money (e.g., currency backed by the US government) as well as alternate currencies like points. That is, alternate currency is a subset of currency. Note that a currency may be stored in an account (e.g., a bank account, a player account).

alternate currency – a currency other than money. Examples of alternate currencies include points, credits, tickets, Beenz, Flooz, frequent flyer miles, and phone minutes. Note that alternate currencies may be used to purchase products, services, and other consideration in a manner similar to how money is used.

game parameter – a variable that affects the performance, scoring, difficulty, outcome, or other aspects of a video game. Examples of game parameters include: factors that affect the difficulty of a video game and numbers of points awarded for achievements in a video game. See Section 8.1.2 for further details.

variance – In this disclosure, the term variance is not limited to the strict mathematical definition of variance, and is understood to include other measurements of distribution. For example, it is understood by those skilled in the art that a standard deviation may be calculated by taking the square root of a variance. Therefore, the term "variance" in this disclosure is understood to encompass related concepts like standard deviation. See Section 8.2 for details about calculating a variance.

6 Points of Focus

6.1 Reducing variance of all prizes in game

- determining a first variance in prizes for a video game
- modifying the video game to produce a modified video game based on the first variance
- wherein the modified video game has a second variance in prizes and the second variance is less than the first variance

6.2 Multiple scores from a single player

- allowing a player to play a video game a plurality of times
- determining a variance in scores by the player in the video game
- modifying the video game based on the variance

6.3 Modifying based on difference between two prizes

- determining at least one first prize won in a video game
- determining at least one second prize won in the video game
- modifying the video game based on a difference between the first prize and the second prize

6.4 Verifying Modification

- determining a first plurality of prizes in a video game
- determining a first variance for the first plurality of prizes
- modifying the video game to produce a modified video game
- wherein the video game is modified based on the first variance
- determining a second plurality of prizes in the modified video game
- determining a second variance for the second plurality of prizes
- wherein the second variance is less than the first variance

6.5 Modification based on a Prize Distribution

- allowing a plurality of players to play a video game
- determining a plurality of scores in the video game for the plurality of players
- determining a first prize distribution based on the plurality of scores
- wherein a prize distribution is an indication of prizes that may be provided to a plurality of players
- modifying the video game based on the first prize distribution

6.6 Result of reducing difference between subsequent prizes

- determining a first prize won by a player in a video game
- modifying the video game based on at least the first prize in order to reduce the difference between subsequent prizes for the player

7 System

According to one embodiment, the controller operates a website accessible over the Internet by a plurality of player devices (e.g., personal computers). Players may operate these player devices to play video games on the website. Figure 1 shows one embodiment of a system that implements the invention.

7.1 Controller

In one embodiment, the controller is a computer system that implements the method of the invention. The computer system may be electronic in nature. One embodiment of the controller is shown in Figure 2.

The **controller** may include the following components:

- a processor
- a communications port (e.g., to communicate with player device)
- an input device (see definition below)
- an output device (see definition below)
- a data storage device (e.g. random access memory, a hard drive)

Definitions of input device and output device:

- **input device** – a device that may be used to receive an input for a computer or other device. An input device may be operated by a user to perform an activity. Examples of input devices include: a computer keyboard, a keypad, a computer mouse, a touch screen, a microphone, a video camera, a bar code reader, a magnetic stripe reader, a biometric input device (e.g., a fingerprint reader, retinal scanner), a voice recognition module.
- **output device** – a device that may be used to output information from a computer or other device. Examples of output devices include: a video monitor, a LCD (liquid crystal display) screen, a light-emitting diode (LED), a touch screen, an audio speaker, a servo motor, a dot-matrix printer, a thermal printer.

The **data storage device** may store at least one of the following:

- a program

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- a game tracking database
- a game statistics database
- a game modification database
- a game parameter database

Figure 3 shows one embodiment of a **game tracking database**, which stores information about games that have been played on the system. According to this embodiment, the game tracking database stores a record for each game that has been played. This record may include:

- a game identifier
- a start time (indicating when a player started playing the game)
- the name of the game being played (e.g., Meteorites, Crosswords, Video Golf)
- the name of the player who plays the game
- the score achieved by the player (e.g., a score in points)

In addition, the game tracking database may also store other information about games played, including the difficulty of a game played, the length of a game, details about how a player played a game, teammates or opponents of the player in a multi-player game, and the entry fee for a game.

Figure 4 shows one embodiment of a **game statistics database**, which stores cumulative information about games that have been played on the system. For each available game, the game statistics database stores information including:

- the name of the game
- the total number of times that the game has been played
- the average score achieved in the game
- the standard deviation of scores achieved in the game

Note that information stored in the game statistics database may be calculated using information stored in the game tracking database. For example, the controller may access the game tracking database to determine all the scores achieved in video golf. The controller may then average these scores to determine the standard deviation in scores in video golf, and store this value in the game statistics database.

Also note that while the term "variance" is used extensively in the disclosure, the example of the invention shown in the figures corresponds to one in which a game is modified based on a standard deviation in prizes. As stated in Section 5, the use of the term "variance" in the disclosure is intended to encompass all measurements of this type, including standard deviation.

Figure 5 shows one embodiment of a **game modification database**, which stores information about modifications that may be made to a video game. In this example, the game modification database stores a list of potential modifications for the game "Meteorites". For each potential modification, this embodiment of the database stores:

- a description of the modification that may be made (e.g., increasing the speed of the player's spaceship by 10-20%).
- an anticipated change in the standard deviation in prizes awarded the game of Meteorites. This information is useful in determining how the standard deviation in prizes of a game may change if a specific modification is made to the game. For example, it is anticipated that increasing the speed the player's spaceship by 10-20% will result increase the standard deviation of prizes awarded by 20 points.

Note that in this embodiment, the listed modifications have not yet been made. Instead, the controller may use this database as a reference to determine which modifications to make to the game. See Section 8.3 for details about modifying a game based on the variance.

Figure 6 shows one embodiment of a **game parameter database**, which stores information that controls the operation of at least one video game. This embodiment of the game parameter database stores a variety of game parameters for the game "Meteorites". For each parameter, this embodiment of the database stores:

- an indication of the game parameter (e.g., number of lives, speed of spaceship)
- an initial value of the game parameter. This initial value may correspond to a value of the game parameter before a method of the invention is used to revise the game.

- a revised value of the game parameter. This revised value may correspond to a value of the game parameter after a method of the invention is used to revise the game.
- an anticipated change in the standard deviation in prizes awarded the game of Meteorites. This value may be determined by accessing the game modification database shown in Figure 5.

The game parameter database shown in Figure 6 also shows a calculation of the cumulative anticipated change in the standard deviation in prizes awarded the game of Meteorites. This calculation is obtained by summing the anticipated changes that result from each modification of the game. According to one embodiment, the controller may modify a game to obtain a particular cumulative anticipated change, thereby modifying the standard deviation in prizes for the game. See Section 8.3 for further details.

The databases shown in Figures 5 and 6 shows one possible way that a video game may be modified according to a method of the invention. A video game may also be modified in a variety of other ways, as described later in Section 8.3.

7.2 Communication Network

The system may include one or more communication networks to allow at least some of the following communication to take place:

- the controller may transmit information to a player device
- a player device may transmit information to the controller

Possible communication networks include a local area network, the Internet, a telephone line, a cable line, a radio channel, an optical communications link, a satellite communications link.

Possible communications protocols include Ethernet, Bluetooth, TCP/IP.

According to one embodiment of the invention, **different communication networks** or different types of communication networks may be used for communication between different devices. For example, the controller may communicate with a first player device using the Internet and communicate with a second player device using a cable line.

7.3 Player Device

According to one embodiment of the invention, a player uses a player device to communicate with the controller. For example, a player may use a personal computer to connect to a website maintained by the controller. Examples of player devices include:

- a personal computer
- a laptop computer
- a personal digital assistant (PDA)
- a telephone
- a cell phone
- a video game terminal
- a set-top box

Player devices like these are known to those skilled in the art and need not be described in detail herein. According to one embodiment, a player device includes the following components:

- processor
- memory
- at least one input device (see definition in Section 7.1)
- at least one output device (see definition in Section 7.1)
- communication port (to communicate using a communication network as described in Section 7.2)

According to one embodiment of the invention, a player may use more than one player device. For example, a player may use a set-top box to play games on his television set, and a cellular telephone to play games and receive bonuses while he is away from home.

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8 Method

According to one embodiment, the invention includes the following steps, which are described in detail in the corresponding subsections.

- Enabling a Player to Play a Video Game (Section 8.1)
- Determining a Variance in Prizes (Section 8.2)
- Modifying the Video Game Based on the Variance (Section 8.3)

8.1 Enabling a Player to Play a Video Game

According to one embodiment, the controller may operate a website or other network-accessible gaming service. Players may log onto this website to play video games and win prizes. This section (Section 8.1) provides an overview of some steps that may be performed by the controller in enabling a player to play at least one video game. It is divided into the following subsections:

- Registration and Entry Fees (Section 8.1.1)
- Game Play (Section 8.1.2)
- Awarding Prizes (Section 8.1.3)

8.1.1 Registration and Entry Fees

According to one embodiment, the controller may **identify a player** who would like to play a video game. Identifying a player may include receiving an indication of information from a player such as a username, password, home telephone number, home address, network address (e.g., IP address), player identification number, or credit card number. The player may provide this indication using a player device.

Information identifying a player may be useful in various ways. Examples include:

- A player's IP address may be useful in allowing the player to play a video game over the Internet.
- A player's username and password may be useful in preventing somebody else from masquerading as the player.
- A player's home address may be useful for providing a bonus to the player.

According to one embodiment, a player may pay an **entry fee** for a game. This entry fee may be optional or required. Examples of entry fees include:

- money and other currencies. For example, a player may pay $0.25 to play a game. In a second example, a player may pay 10 tickets to play a game. Examples of **alternate currencies** include tickets, credits, points, Beenz, frequent flyer miles, and minutes of long distance phone time. In one embodiment, a player may purchase an alternate currency (e.g., tickets) using money or some other form of consideration.
- other forms of consideration (e.g., providing services or products, performing activities, viewing advertisements)

According to one embodiment, a player may provide a **payment identifier** to pay an entry fee for a game. Examples of payment identifiers include:

- a credit card number
- a debit card number
- a financial account number
- a billing address

According to one embodiment, an entry fee for a game may be paid at various different **times**. Examples include:

- An entry fee may be paid at the start of a game. For example, a player may be asked to pay 1 ticket to play a game of Meteorites.
- An entry fee may be paid after a game is finished. For example, a player who just finished playing 5 games of Meteorites may be asked to pay 5 tickets for these games.
- An entry fee may be paid during a game. For example, a game of Meteorites may pause and prompt a player, "If you want to continue, please click here to pay 1 ticket."
- An entry fee may be paid over time. For example, a player may be billed at a rate of 10 tickets per hour for playing video games.

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- An entry fee may be paid when a player purchases a prize. For example, a player may be permitted to play video games for free and earn points for winning these video games. These points may in turn be used as an alternate currency to purchase prizes. However, in order for a player to purchase a prize using points that he has won, he may be required to pay the entry fees for one or more of the video games that he has played.

According to one embodiment, entry fees may be different for different games. Examples include:

- It may cost a player 1 ticket to play a game of Pac-Man, but 6 tickets to play 18 holes of golf.
- Player may **share an entry fee** for a game. For example, Alice and Bob may decide to work together to solve a crossword puzzle. If an entry fee for a single-player crossword puzzle is normally 4 tickets, Alice and Bob may split this fee between them and each pay 2 tickets (Alternatively, they could split the entry fee unevenly; Alice might pay 3 tickets, while Bob might pay 1 ticket). If Alice and Bob win a prize in the game, then they may split the prize using one or more agreed-upon rules (e.g., prize is split 50%-50%, prize is split according to ratio of entry fees paid by the players, prize is split according to which player scored the most points).

8.1.2 Game Play

According to one embodiment, the controller may enable a player to play one or more video games. Examples of video games that may be played by a player include:

- single-player games (e.g., crossword puzzles, Pac-Man, Solitaire)
- player vs. player games (e.g., chess, Scrabble, Ultima Online, poker)
- team games (e.g., bridge, Gauntlet)
- games of skill (e.g., trivia, Quake, Scrabble, mazes)
- games of chance (e.g., blackjack, bingo)

According to one embodiment, the controller may **receive a selection** of a game that a player would like to play. For example, a player may use a player device to select a game that he would like to play from a list of available games.

According to one embodiment, the controller may transmit information to a player device to be **displayed** to a player using an output device. For example, the controller may transmit an image of a crossword puzzle to a player. In a second example, an audio recording of a trivia question may be output to a player through his cellular telephone.

Note that while the term "video game" is used, a video game may not have any video component. For example, an all-audio game that is played over a telephone would also qualify as a video game.

According to one embodiment, the controller may receive one or more **game inputs** from a player, which may affect game play. For example, a player may use a keyboard on a personal computer to answer a trivia question. In a second example, a player may use a joystick attached to a set-top box to control a race car in a video game.

According to one embodiment, a video game may include one or more **game parameters**. These game parameters may be variables that affect the performance, scoring, difficulty, outcome, or other aspects of the video game. Examples of game parameters include:

- factors that affect the difficulty of a video game (e.g., complexity of a game, hints provided, the sensitivity of controls, difficulty of trivia questions, number of opponents)
- a number of points awarded for an achievement in a video game (e.g., 200 points for killing a monster, 300 points for solving a puzzle)
- factors that affect a player's ability to score points in a video game (e.g., maximum number of points possible, number of bonus items available)
- rules of a video game (e.g., number of strikes allowed in a baseball video game, cost of vowels in a word guessing game)
- factors that affect the duration of a video game (e.g., a number of rounds, a number of lives)
- factors that affect the entertainment value of a video game (e.g., quality of animation, background music)
- a seed value for a random number generator

- algorithms that control how points are awarded (e.g., a formula for the number of bonus points that a player receives at then end of a round of a video game)
- algorithms for adjusting a game based on a player's rating (e.g., a game may be adjusted to be more difficult for an expert-level player)
- algorithms that control computer opponents (e.g., a number of moves that a computer opponent looks ahead in chess)

According to one embodiment, game parameters for a video game may be stored in **a game parameter database**, such as the one shown in Figure 6 and described in detail in Section 7.1.

According to one embodiment, the controller may provide one or more **prizes** to a player **during a game.** A prize may be any form of consideration, including currencies (e.g., money, points), products, and services. For example, a player may score 300 points for answering a trivia question correctly in a game that has 10 trivia questions. In another example, a player may receive 200 points for killing a monster in a maze video game.

According to one embodiment, a game may be hosted by a device other than the controller. For example, the controller may act as a listing service for a peer-to-peer network in which players play games against each other (e.g., Battle.net)

According to one embodiment, a player may play **multiple games** simultaneously. For example, a skilled player may play 2 games of trivia at the same time. In a second example, a player may play 3 hands of blackjack at the same time.

8.1.3 Awarding Prizes

According to one embodiment, the controller may determine an outcome for a video game played by a player. The outcome may be based on inputs provided by the player as well as other factors related to game play (e.g., rules of the game, inputs by other players, random numbers).

According to one embodiment, at least one **prize** may be awarded to a player based on an outcome of a video game. Examples of prizes include:

- money and other currencies. Examples of alternate currencies include tickets, credits, points, Beenz, frequent flyer miles, and minutes of long distance phone time.
- products (e.g., a toaster oven)
- services (e.g., a free game, access to premium gaming services)
- other forms of consideration

According to one embodiment, information about a video game that has been played by a player may be stored by the controller in a **game tracking database**. For example, a game tracking database may be used to store the total number of points awarded each time a game is played. One embodiment of a game tracking database is shown in Figure 3 and described in detail in Section 7.1.

According to one embodiment, points that are scored in a game may be used as a currency to purchase prizes. For example, a player may score points for events during a game of Meteorites (e.g., 200 points for destroying a small meteorite), and finish the game of Meteorites with a total of 3500 points. The player may then combine these 3500 points with 16800 other points that he has won to purchase a prepaid phone card. The controller may then debit these points from the player's account as part of a transaction. In one embodiment, a player may **combine points** that are scored in multiple different games to purchase a single prize. Points scored based on game events during a first game may be equivalent to points scored based on game events in a second game.

Alternatively, points that are scored in a game may be **converted** into credits or money that may be used to purchase prizes. For example, player may score 12309 points in a game of trivia. These 12309 points may be converted to 3200 credits using a function or a conversion table. The player may then use these 3200 credits to purchase prizes. According to one embodiment, points may be converted into credits in such a manner than most point values convert to approximately the same value in credits. For example, the following formula may be used to convert points to credits, money or some other currency used to purchase prizes:

- (number of credits) = 1000 + 100*(points scored)/(maximum points possible in game)

By using a formula like this one to convert points into credits, the controller may ensure that most players will receive the same number of credits and poor players will not be discouraged (e.g., all players will win approximately 1000 credits per game).

According to one embodiment, a prize of a currency may be credited to an **account** belonging to a player. For example, a player may win $3 in a game of trivia. This money may be stored in a bank account belonging to the player, as identified by a payment identifier (e.g., a bank account number). In a second example, a player may win 3400 points in a game and these points may be credited to his account in a player database stored by the controller (The player database is not shown in the Figures).

8.2 Determining a Variance in Prizes

As mentioned earlier, the controller may store information about games played in a **game tracking database**, such as the one shown in Figure 3. The game tracking database may store all sorts of information about games played- see Section 8.1 for examples of different types of information that may be stored in the game tracking database.

According to one embodiment, the controller may determine **variance in prizes** awarded to players. For example, the controller may determine the variance in prizes awarded in the game Meteorites by using the game tracking database to determine all the prizes awarded in games of Meteorites during the last month. The controller may then calculate the variance in this set of prizes. According to one embodiment, variance may be calculated using a formula such as:

$$\sigma^2 = \frac{1}{n}\sum_{i=1}^{n}(X_i - \mu)^2$$

where: σ^2 is the variance
n is the number of elements in the set
i is the index of the current element
$\mathbf{X_i}$ is the current element (e.g., the prize awarded in a game)
μ is the mean (average) value of the elements in the set

Note that μ (the mean value of the elements in the set) may be calculated using a formula such as:

$$\mu = \frac{1}{n}\sum_{i=1}^{n}X_i$$

According to one embodiment, the controller may also calculate a **standard deviation in prizes** using a formula such as:

$$\sigma_x = \sqrt{\sigma_x^2} = \sqrt{VAR(X)} = SD(X)$$

Note that a variance is typically calculated over a specified **data set**. (i.e., the set of games or prizes over which the variance should be calculated). In different embodiments of the invention, the controller may calculate a variance in prizes over a variety of different data sets. Example data sets include:

- all games played during a specific period of time (e.g., all games played in the last week, all games played within two weeks after a promotion)
- all games played by a particular player (e.g., all games played by player #2134-1234-51)
- all games played by a specific type of player (e.g., all games played by expert-level players)
- all games played by new players (e.g., players who signed up within the last two weeks)
- all games of a specific type (e.g., all Super Trivia games)
- all games with a specific entry fee (e.g., all games that cost 2 tokens to play)
- an intersection of two or more data sets (e.g., all Meteorites games played during the last week)
- a union of two or more data sets (e.g., all Mystery Maze or Crosswords games)

According to one embodiment, the controller may **determine a data set** of games based on a **selection condition**. For example, this selection condition may be a Boolean expression; only games for which the selection condition is true will be included in the data set. The controller may search through the game tracking database to select chose games which meet the specified selection condition. Examples of selection conditions include:

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- (GAME_TYPE = "Meteorites") AND (START_TIME > "Mon, 12/10/01, 5pm")
- (PLAYER_TYPE = "Expert") OR (PLAYER_TYPE = "Intermediate")
- (ENTRY_FEE = "2 Tokens") AND (PLAYER_TYPE = "Beginner")

Note that, according to one embodiment, the controller calculates a variance in the **prizes** awarded in a set of games. Note that prize is defined in Section 5 to be:

- **prize** – consideration that is provided to a player based on a result of at least one video game. Examples of prizes include currency (e.g., money, points), products, services.

Of course, it is also possible to calculate a variance in other values relating to games. For example, in one embodiment, a prize awarded in a game may be different from a score achieved in the game (e.g., prizes of tickets may be awarded based on a player's score in a game). In such an embodiment, the controller may calculate a **variance in scores** in games rather than a variance in prizes. Similarly, the controller may calculate a variance in other characteristics of games that are indicative of achievement in a game (e.g., a number of levels completed, a number of lives lost, a total time spent playing, a number of questions answered correctly).

According to one embodiment, **multiple prizes** or scores may be awarded in a single game. In such an embodiment, each of the prizes may represent a separate element in the data set, or the prizes may be summed together to determine the total prize for the game.

According to one embodiment, information about the variance in prizes of one or more games may be stored by the controller in a **game statistics database**. One embodiment of a game statistics database is shown in Figure 4 and described in detail in Section 7.1. Note that the game statistics database shown in Figure 4 stores a standard deviation in scores for each game type; this value may be obtained by taking the square root of the variance in scores for each game type.

8.3 Modifying the Video Game Based on the Variance

According to one embodiment, the controller may determine whether a calculated variance in prizes for a video game is too high or too low. Based on this determination, the controller may then modify the video game to resolve the discrepancy (e.g., by changing one or more game parameters). An overview of this modification process is provided the following subsections:

- Section 8.3.1 – Determining Whether to Modify a Game
- Section 8.3.2 – Modifying a Game Parameter

8.3.1 Determining Whether to Modify a Game

According to one embodiment, the controller may determine whether a calculated variance in prizes for a video game is too high or too low. Examples of determinations that may be made by the controller include:

- The variance in prizes for a particular data set (e.g., a particular type of player, a particular type of game) is **too low**. If this occurs, then players may become bored because they always get approximately the same score. To avoid this problem, the controller may modify a game to increase the variance in prizes.
- The variance in prizes for a particular data set (e.g., a particular type of player, a particular type of game) is **too high**. If this occurs, then some players may become discouraged because the game is too unpredictable or because the prizes they win in the game are much less than the top level prizes in the game. In this case, the controller may modify a game to decrease the variance of prizes.

According to one embodiment, the controller may compare the **variance of prizes for multiple different data sets** and modify a video game based on this comparison. Examples include:

- According to one embodiment, the controller may attempt to standardize the variance for a plurality of different types of games. So if Meteorites has a standard deviation of 200 points per game and Super Trivia has a standard deviation of 100 points per game, then the controller may determine that the variance for Meteorites is too high and the variance for Super Trivia is too low. It may then respond by modifying both games to have a standard deviation of 150 points.

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- According to one embodiment, the controller may attempt to standardize the variance in prizes for different types of players in one or more types of games. So if novice players have a variance of 100 points per game in Meteorites and expert players have a variance of 200 points per game in Meteorites, the controller modifies the Meteorites game to increase the variance for novices and decrease the variance for experts.
- According to one embodiment, the controller may attempt to ensure that the variance in prizes for a data set does not vary over time. To do this, the controller may calculate the variance in prizes for a data set during a first time frame (e.g., the month of September) and during a second time frame (e.g., during the month of October), and then compare the two variances. If the variance in October is greater than the variance in September, then the controller may modify a game to reverse the trend.

According to one embodiment, the controller may modify a game based on **standard values for variance**. For example, the controller may determine ideal minimum and maximum levels of variance in prizes for a game. If the variance for the game rises above the ideal maximum variance or below the ideal minimum variance, then the controller may take steps to modify the game and resolve the problem. According to one embodiment, standard values for variance may be provided by an operator of the controller (e.g., an employee of a company that runs a gaming website). Alternatively, or in addition, the controller may determine ideal values for variance using data mining or artificial intelligence algorithms.

According to one embodiment, the controller may determine **how much to change** the variance of a game. For example, the controller may determine that currently the standard deviation in prizes awarded in the game of Meteorites is 435 points (e.g., as shown in the game statistics database shown in Figure 4). Continuing this example, the controller may determine that Meteorites should be modified to reduce the standard deviation to approximately 200 points. Similarly, the controller may determine that the standard deviation should be reduced by 235 points. In a second example, the controller may determine to increase the variance in scores for novice players by 100 points.

8.3.2 Modifying Game Parameters

The controller may use any of a variety of different methods to modify a game and increase or decrease a variance is prizes. This section describes one possible method of modifying a game.

Figure 5 shows one embodiment of a **game modification database** that may be stored by the controller. This database stores a variety of possible modifications that may be made by the controller, along with the anticipated consequences of these modifications. For example, this embodiment of the game modification database shows that if the controller modifies the Meteorites game to increase the speed of a player's spaceship by 10-20%, then it is anticipated that this change will increase the standard deviation in prizes awarded in the game by 20 points (e.g., because expert players will be able to take advantage of the speed difference and maneuver around meteorites more easily, while novice players may have difficulty controlling the spaceship at higher speeds). In a second example, decreasing the precision of the heading controls for a player's spaceship may decrease the standard deviation of prizes awarded, since expert players will no longer be able to aim precisely enough destroy meteorites from a long distance away. Information stored in the game modification database may be provided by an operator of the controller, or determined by the controller by monitoring games played by players (e.g., through data mining).

Note that the modifications listed in this embodiment of the game modification database generally pertain to modifying one or more **game parameters**. As defined in Section 8.1.2 a game parameter may be any "variable that affects the performance, scoring, difficulty, outcome, or other aspects of a video game." Numerous examples of game parameters are provided in Section 8.1.2.

In the embodiment of the game modification database shown in Figure 5, it is assumed that the effects of most modifications to a game are substantially **independent**. That is, if the controller were to make two modifications to the game of Meteorites, the resulting effect on the standard deviation of prizes in the game would be the sum the two effects that would result if each of the modifications were made on their own. For example, this embodiment of the game modification database indicates that if the controller were to:

- increase the speed of a player's spaceship by 10-20%, and

- increase the number of lives from 3 to 5

then the cumulative anticipated effect would be to decrease the standard deviation in prizes for the game of Meteorites by 30 points (i.e., 20 points minus 50 points).

It is also possible that modifications to a game may be **dependent** on one another. For example, the game modification database shown in Figure 5 shows that, in order to increase the standard deviation prizes in Meteorites by 90 points, the controller needs to make two changes:

- increase the number of hits needed to destroy a small meteorite by 30-50%, and
- increase the speed of small meteorites by 20-30%

The controller may use the game modification database to determine how a game should be modified to achieve a particular variance. For example, as described in Section 8.3.1, the controller may determine that it should decrease the standard deviation of prizes awarded in Meteorites by at least 50 points. To accomplish this, the controller may select one or more modifications from the game modification database. For example, the controller may make the following modifications to Meteorites, thereby achieving a cumulative effect of decreasing the standard deviation of the game by 65 points:

- decrease the speed of a player's spaceship by 10-20% (an effect of – 30 points)
- increase the number of lives from 3 to 5 (an effect of – 50 points)
- increase the speed of missiles by 10-20% (an effect of +15 points)

Note that while the cumulative effect is to decrease the standard deviation, some modifications (e.g., increasing the speed of missiles) may increase the standard deviation when taken individually.

According to one embodiment, information about how game parameters are modified is stored in **a game parameter database**, such as the one shown in Figure 6. This figure shows how the controller may modify game parameter values based on a variance. In this example, the controller has determined that the variance in the game "Meteorites" is too high relative to the other games provided on the system and should be decreased by approximately 235 points. (Note that the standard deviation of Meteorites is 435; most of the other games have standard deviations of less than 200 points.) To decrease the variance of prizes in the Meteorites game, the controller modifies various game parameters (e.g., based on information provided in the game modification database). For example, as shown in the first row of the database, the controller increases the number of lives in the game from 3 to 10. As shown in both Figure 5 and Figure 6, the anticipated result of this change is that the standard deviation of prizes awarded in Meteorites should decrease by 50 points.

Note that in the example shown in Figure 6, the controller made one modification of dependent game parameters- the points awarded for destroying a small meteorite and the points awarded for destroying a large meteorite. As shown in Figure 5 (and discussed earlier), it is anticipated that making both of these changes simultaneously will decrease the standard deviation of prizes awarded by 100 points. In this example, it is not undetermined what would happen if the controller were to modify only one of these game parameters.

The **anticipated cumulative effect** of the modifications made by the controller is determined by summing the results of each of the individual modifications. In the example shown in Figure 6, the anticipated cumulative change in standard deviation in prizes awarded in Meteorites is a decrease of 225 points. (this value is shown at the bottom of the figure).

According to one embodiment, the controller may **verify that a modification to a game is successful**. For example, the controller may modify a game Meteorites to decrease the variance. After this modification is performed, the controller may use the game tracking database to record data about players playing the new, modified version of Meteorites. Using this data, the controller may compute a variance in prizes for the new, modified version of Meteorites and verify that this new variance is in fact less than the original variance in prizes by the correct amount. If the modification of the game was not completely successful, another modification may be performed. Note that in this manner, the controller may use **feedback** to determine which modifications are most successful in altering the variance for a game.

9 Figures

Figure 1 shows one embodiment of a system utilizing the invention. See Section 7 for details about the system.

Figure 2 shows one embodiment of the controller shown in Figure 1. See Section 7.1 for details about the controller.

Figure 3 shows one embodiment of a game tracking database stored by the controller. See Section 7.1 for details.

Figure 4 shows one embodiment of a game statistics database stored by the controller. See Section 7.1 for details.

Figure 5 shows one embodiment of a game modification database stored by the controlled See Section 7.1 for details.

Figure 6 shows one embodiment of a game parameter database stored by the controller. See Section 7.1 for details.

10 Alternate Embodiments

10.1 Game Play by Bots

According to one embodiment, a "bot" or computer program may take the place of a player in playing a video game. For example, the controller may simulate play of a video game using one or more "bots". These bots may be computer programs that are designed to play the video game in a manner similar to that that which would be employed by a human player. The controller may then calculate a variance in prizes awarded to these bots and then modify the video game based on this variance.

If these bots can be designed well enough to replicate the play of human players, then there are numerous advantages to this form of test of games, including:

- It may be difficult or costly to attract a large number of human players to test unproven games. In contrast, bots are easy to duplicate and therefore large numbers of bots can be produced quickly and cost effectively.
- Human players may take a long time to play games, meaning that months of testing may be required to perfect a game. Bots can play a game very quickly (e.g., much faster than real time) and continuously (e.g., they don't need to take time out to eat or sleep). Therefore testing of a game can be finished in a shorter period of time when bots are used.

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