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(54) **MIND CONTROLLED CASINO GAME**

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A63F 13/00	(2014.01)
G06F 17/00	(2006.01)
G06F 19/00	(2011.01)
G07F 17/32	(2006.01)
G06F 3/01	(2006.01)

(52) **U.S. Cl.**
CPC ***G07F 17/3262*** (2013.01); ***G07F 17/3206*** (2013.01); *G06F 3/011* (2013.01); *G06F 3/015* (2013.01); *G07F 17/3209* (2013.01)

(58) **Field of Classification Search**
CPC G06F 3/015; G06F 3/011; G07F 17/3209; G07F 17/3206
See application file for complete search history.

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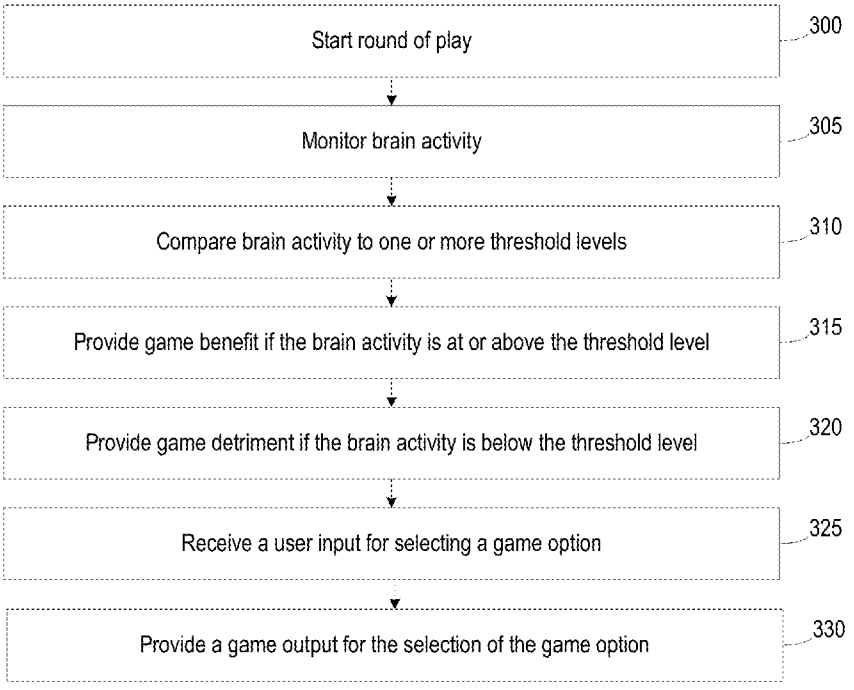
(57) **ABSTRACT**

A computerized method for an electronic casino game includes starting a round of play of the electronic casino game, and monitoring a user's brain activity. The method includes determining whether at least one component of the user's brain activity exceeds a threshold level, and changing a chance of winning the round of play if the at least one components of the user's brain activity exceeds the threshold level. Changing the chance of winning the round of play may include increasing the chance of winning the round of play.

28 Claims, 7 Drawing Sheets



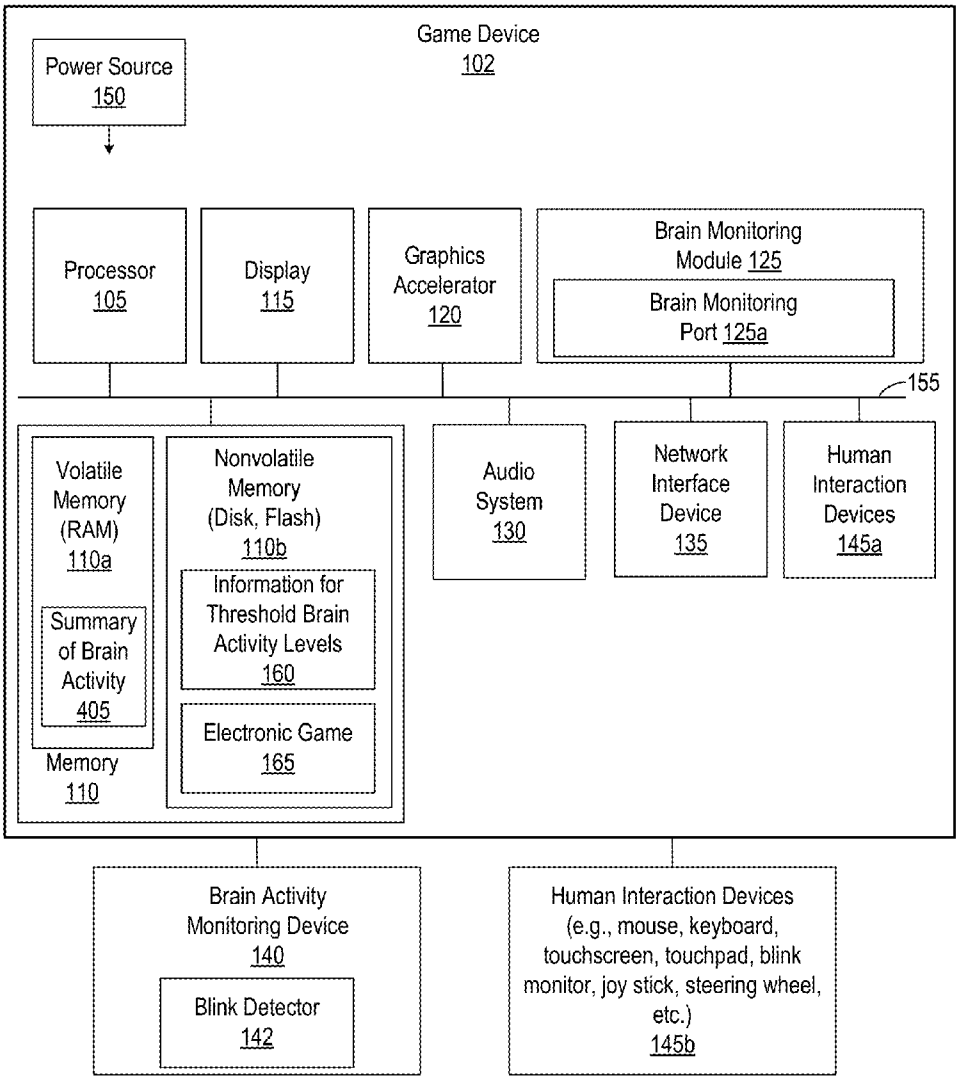

Game Device
102
Power Source
150
Processor
105
Display
115
Graphics
Accelerator
120
Brain Monitoring
Module 125
Brain Monitoring
Port 125a
155
Volatile
Memory
(RAM)
110a
Summary
of Brain
Activity
405
Memory
110
Nonvolatile
Memory
(Disk, Flash)
110b
Information for
Threshold Brain
Activity Levels
160
Electronic Game
165
Audio
System
130
Network
Interface
Device
135
Human
Interaction
Devices
145a
Brain Activity
Monitoring Device
140
Blink Detector
142
Human Interaction Devices
(e.g., mouse, keyboard,
touchscreen, touchpad, blink
monitor, joy stick, steering wheel,
etc.)
145b

Figure 1

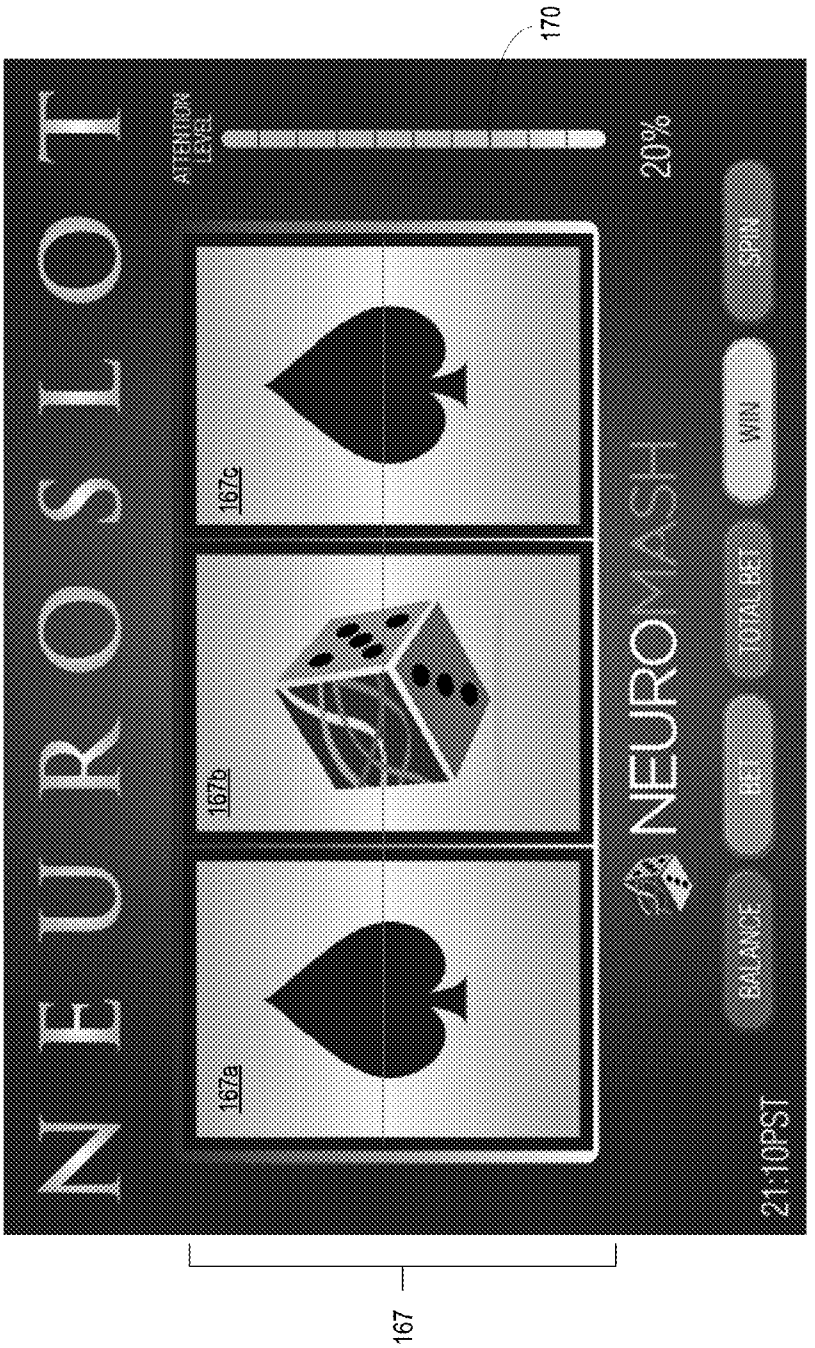

170
NEUROSLOT
ATTENTION LEVEL
20%
167a
167b
167c
NEUROMASH
BALANCE
BET
TOTAL BET
WIN
SPIN
21:10PST
167

Figure 2A

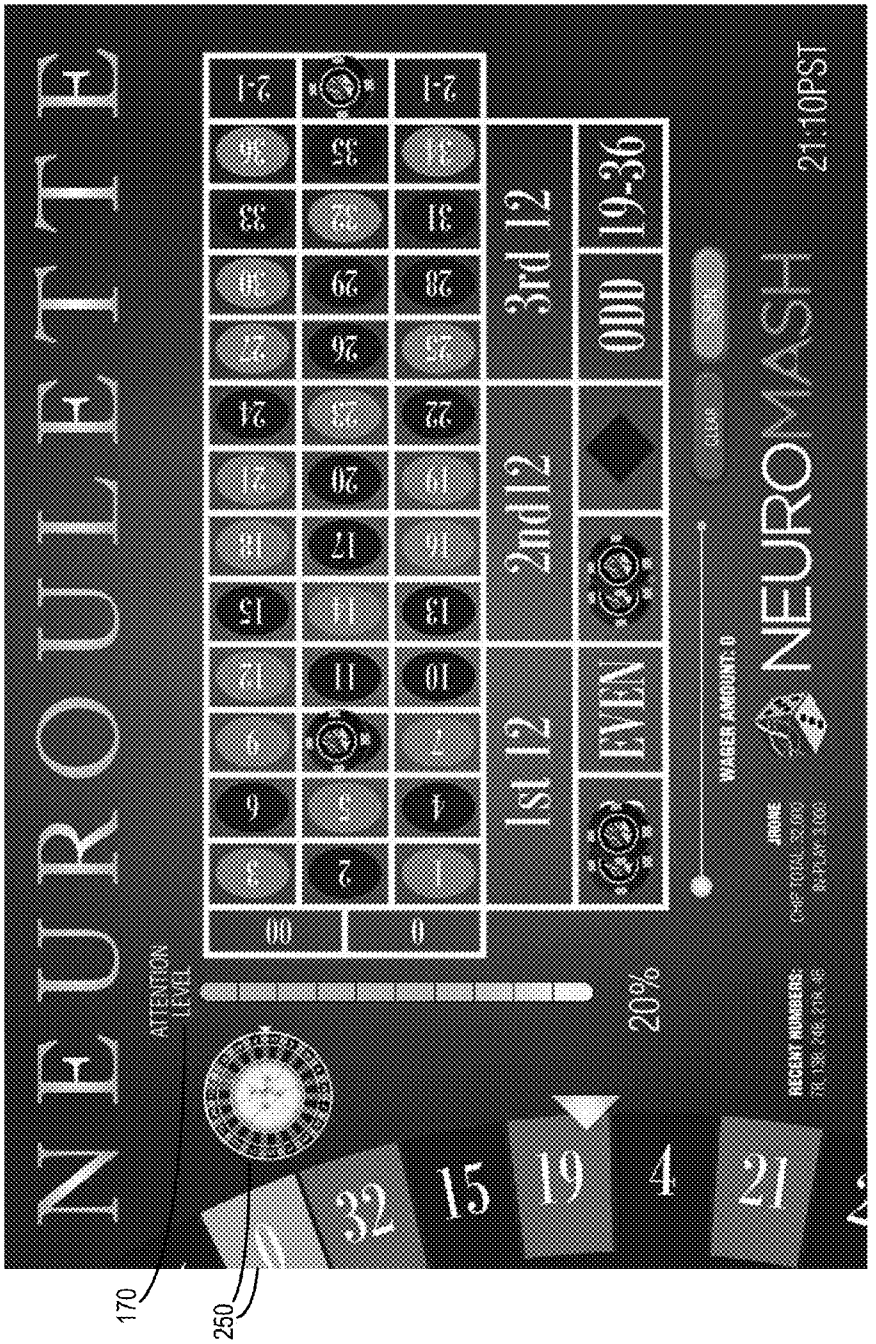

NEUROULETTE
ATTENTION LEVEL
00
0
1st 12
2nd 12
3rd 12
EVEN
ODD
1-18
19-36
20%
NEUROMASH
21:10PST
32
15
19
4
27
170
250

Figure 2B

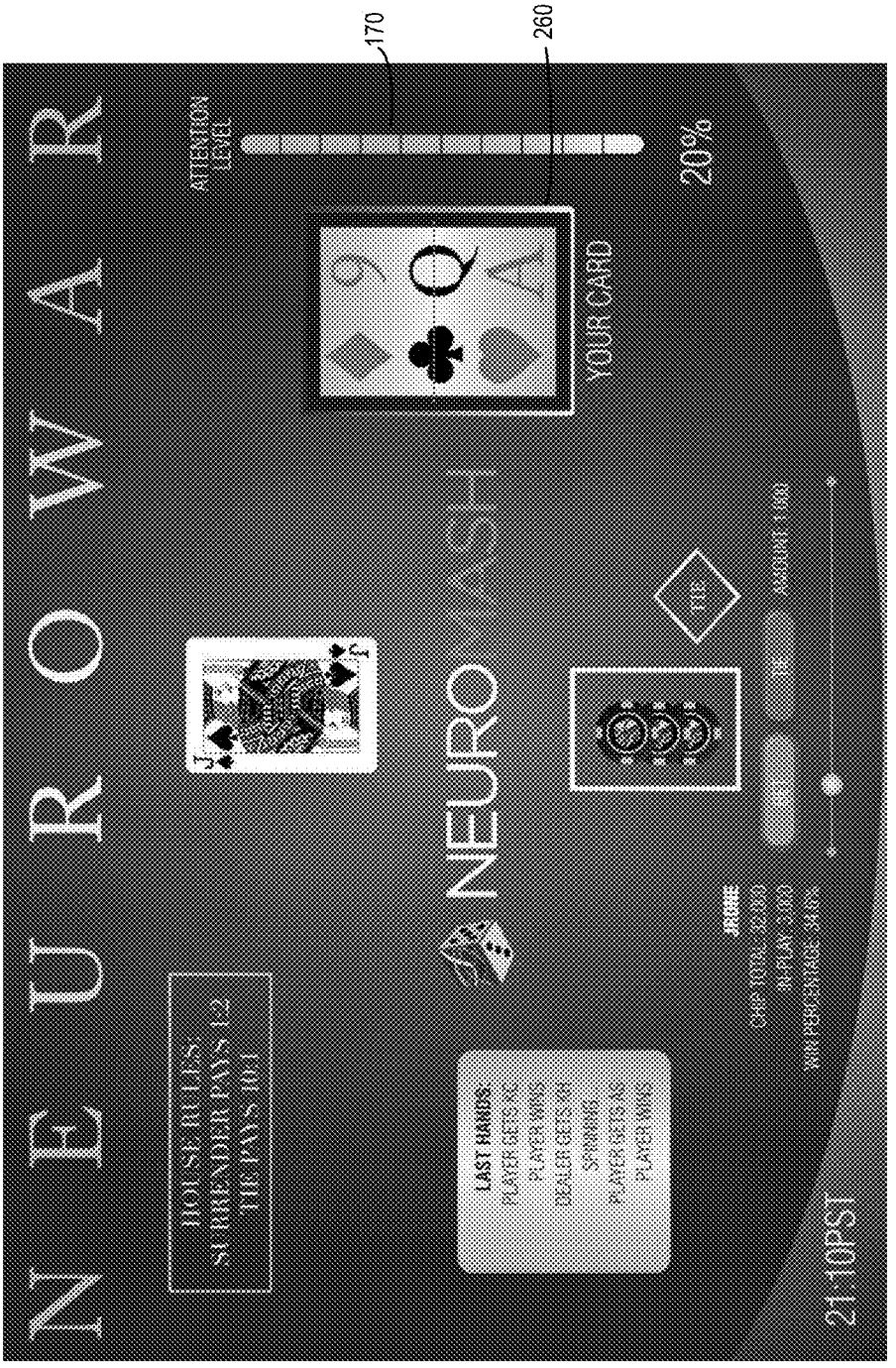

NEUROWAR
ATTENTION LEVEL
170
260
20%
YOUR CARD
NEURO
TIE
2110PST

Figure 2C

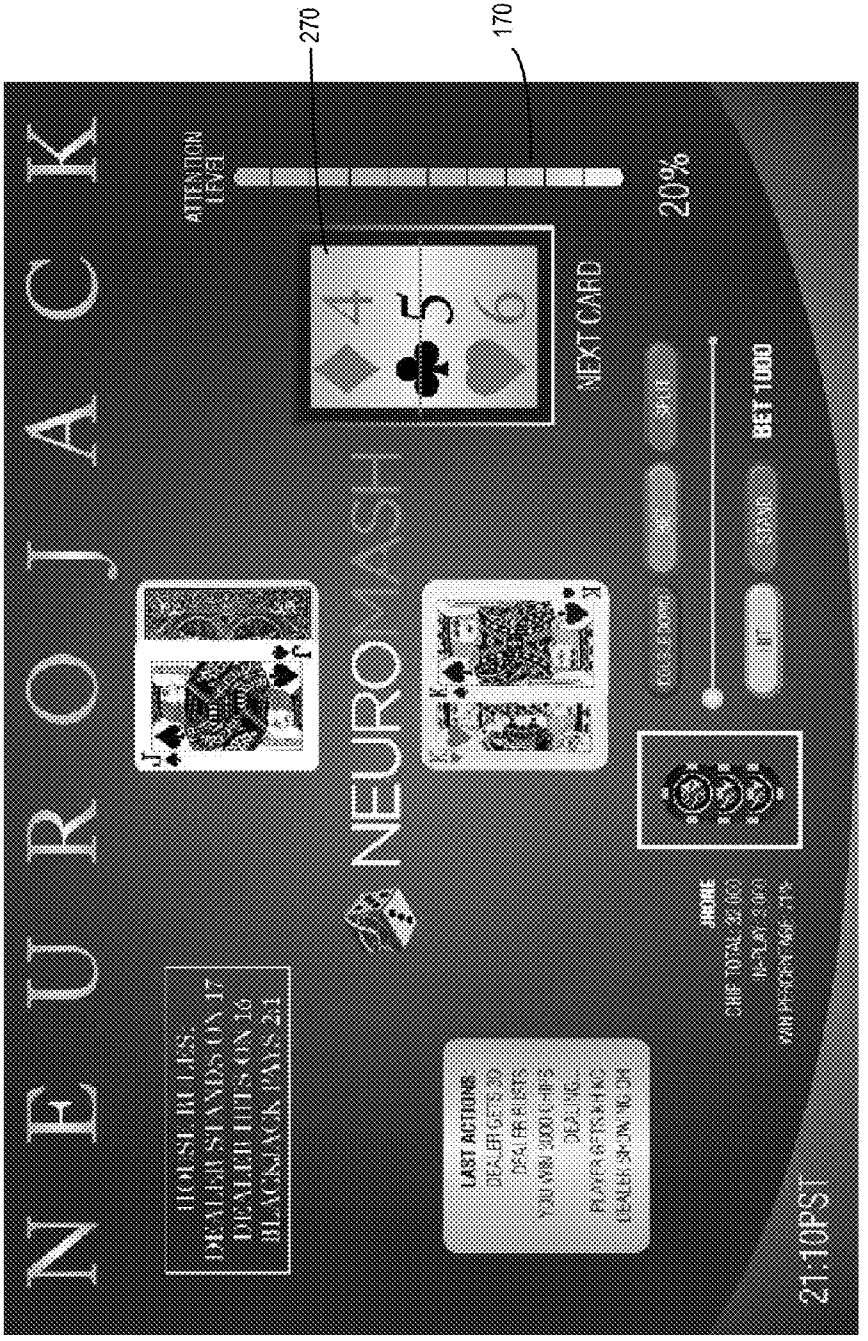

270
170
NEUROJACK
NEUROMASH
ATTENTION LEVEL
20%
NEXT CARD
BET 1000
LAST ACTIONS
21:10PST

Figure 2D

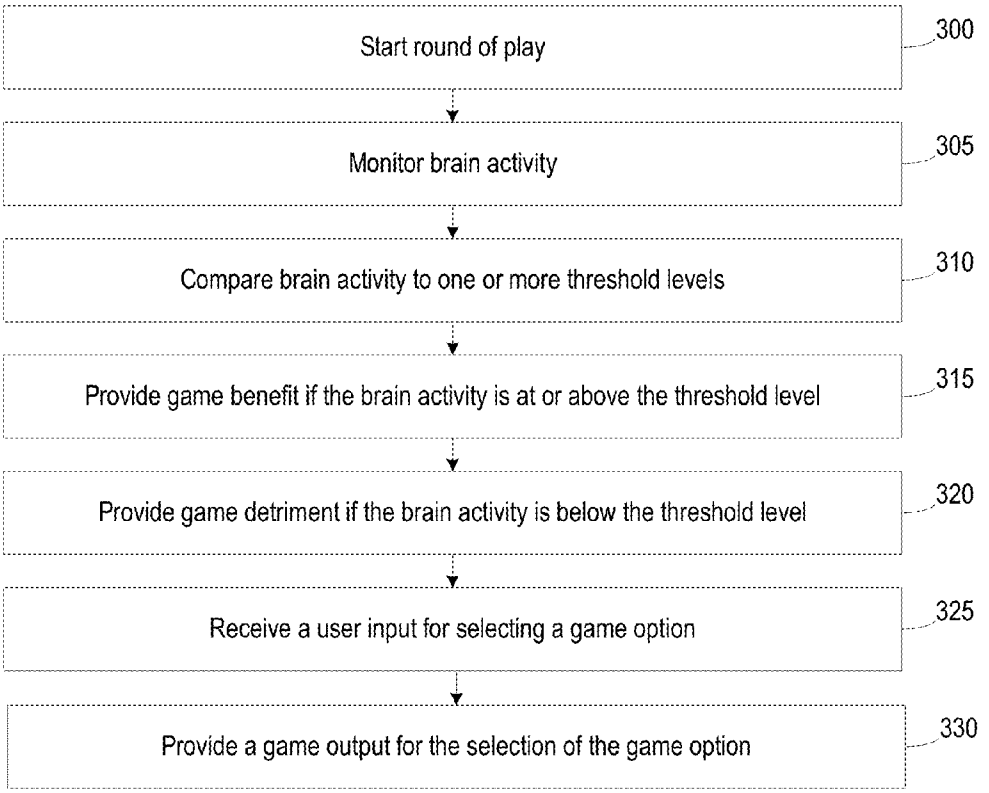

Start round of play
300
Monitor brain activity
305
Compare brain activity to one or more threshold levels
310
Provide game benefit if the brain activity is at or above the threshold level
315
Provide game detriment if the brain activity is below the threshold level
320
Receive a user input for selecting a game option
325
Provide a game output for the selection of the game option
330

Figure 3

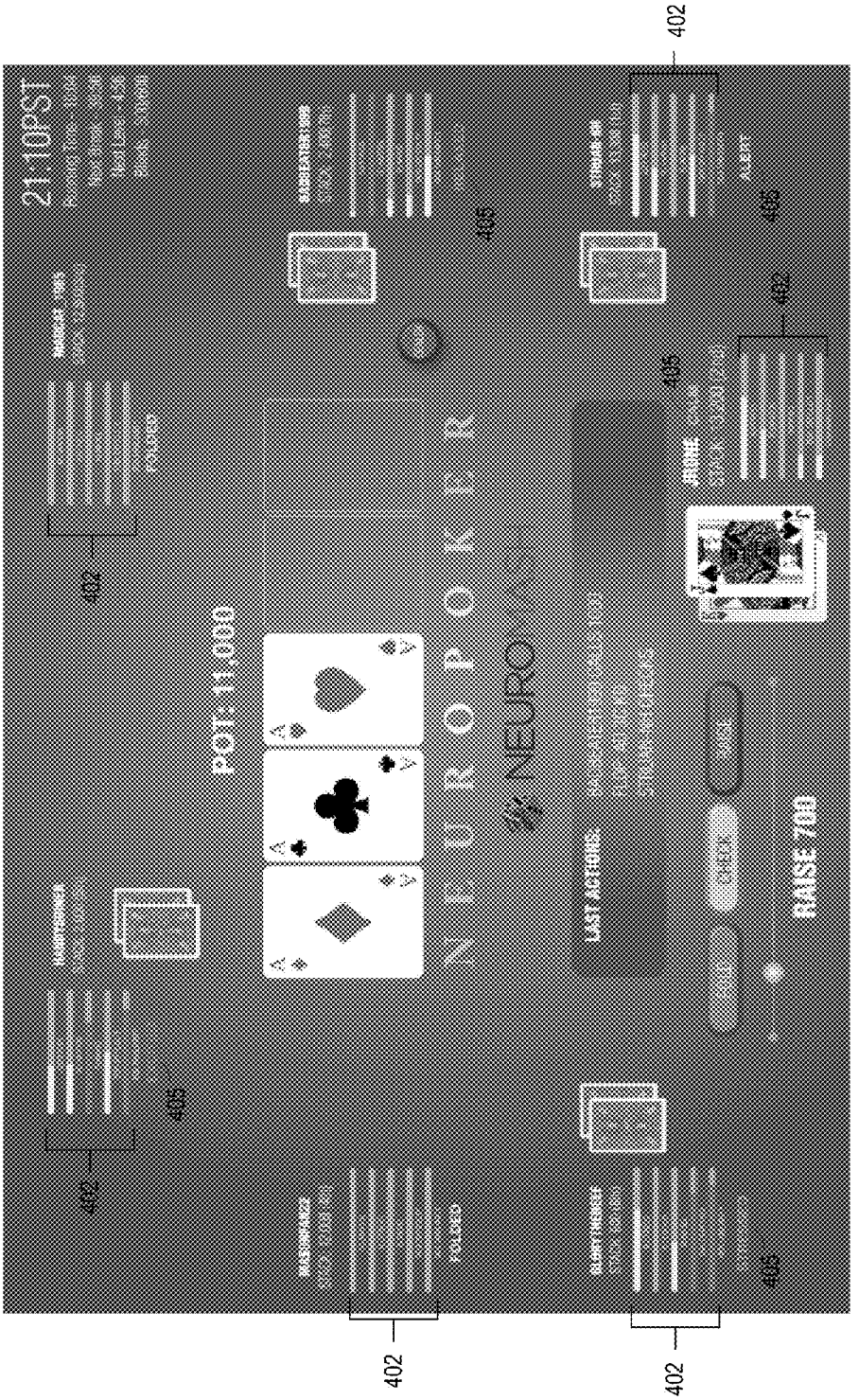

21:10PST
POT: 11,000
NEUROPOKER
NEURO
LAST ACTIONS:
RAISE 700
402
405

Figure 4

MIND CONTROLLED CASINO GAME

CROSS-REFERENCE TO RELATED APPLICATIONS

This patent application claims the benefit of U.S. Provisional Patent Application No. 61/618,901, filed May 21, 2012, titled "Notification of Gaming Control Through Brain and Blinking Monitoring of End User Concentrations", which is incorporated by reference along with all other references cited herein.

BACKGROUND OF THE INVENTION

The present invention generally relates to electronic games and electronic gaming systems. More particularly, the present invention relates to process management of an electronic game by monitoring of brain functions and utilization of brain signal.

Electronic gaming involves human interface with a user interface of an electronic system so that the electronic system will generate feedback for user play of an electronic game. Electronic systems that are configured for electronic game play are often referred to as game platforms or game systems. Examples of game systems include computers and video game consoles. These game systems range from large mainframe computers to small handheld devices.

Game systems include a combination of electronic components, which, in conjunction with low-level software, allow electronic games to operate on the game systems. The electronic components of a game system may be integrated into a single device, such as a small handheld device, or may include distributed components. For example, a personal computer that is configured to operate as a game system may be configured to connect one or more game controllers for controlling game play and to a separate video monitor that displays a graphical user interface for a electronic game. A console game system might similarly be configured to be connected separate game controllers and a video monitor, such as a television. A handheld gaming device, in contrast, may be a self-contained electronic device that includes an integrated display and integrated game controller for game play.

Game controllers that are often used for controlling electronic games include a variety of device types, such as computer mice, keyboards, joysticks, touch screens, steering wheels, or the like. For example, personal computer games that operate on personal computers often require the use of a keyboard or joystick for game play, or may require the substantially simultaneous use of a keyboard and computer mouse for game play. These game controllers are configured to receive tactile input from a user for controlling an electronic game. However, tactile input for game control is limiting and often drives the types of games that can be developed for game systems. Therefore, game developers that have a desire to develop new games also often have a desire to develop new types of game controllers.

BRIEF SUMMARY OF THE INVENTION

Embodiments of the present invention are generally related to electronic games and electronic game systems, and more specifically provide for interactive electronic gaming through brain monitoring of a user's specific conscience states, such as conscience states associated with a combination of a user's five brain waves.

According to one embodiment, a computerized method for an electronic casino game includes starting a round of play of the electronic casino game; monitoring a user's brain activity; determining whether at least one component of the user's brain activity exceeds a threshold level; and changing a chance of winning the round of play if the at least one components of the user's brain activity exceeds the threshold level.

According to a specific embodiment, the chance of winning the round of play includes increasing the chance of winning the round of play. The method may include lowering the chance of winning the round of play if the user's brain activity equals the threshold level or is below the threshold level. Alternatively, the method may include lowering the chance of winning the round of play if the user's brain activity is below a second threshold level, wherein the first threshold level is different from the second threshold level. Changing the chance of winning may include changing a game attribute of the electronic casino game, such as changing a rate of information presented on a display. The rate of information may include a rate at which at least one game wheel (such as a slot machine wheel, a roulette wheel, or the like) is presented on the display, or may include a rate of presenting cards to be dealt. If the rate is lowered, then a user may have a higher chance of selecting a winning combination of slot machine wheels, cards for an electronic card game, or the like. If the rate is increased, the user may have a lower chance of selecting a winning combination of slot machine wheels, cards, or the like.

According to another specific embodiment, the method includes presenting at least one component of the user's brain activity on a plurality of displays, wherein the electronic casino game is a multi-user game configured for play by a plurality of users. The displays may be respectively associated with the users. The method may also include presenting a summary of the user's brain activity of each of the users on the plurality of displays. The information for the brain activity and the summary may be presented by an electronic poker game.

According to another embodiment, a non-transitory computer-readable storage medium comprising instructions for operating an electronic casino game, wherein the instructions, when executed, are for controlling a computing device to be configured for: starting a round of play of the electronic casino game; monitoring a user's brain activity; determining whether at least one component of the user's brain activity exceeds a threshold level; and changing a chance of winning the round of play if the at least one components of the user's brain activity exceeds the threshold level.

According to another embodiment, a computing device for operating an electronic casino game, the computing device includes a processor; and a computer-readable storage medium comprises instructions for controlling the processor to be configured for: starting a round of play of the electronic casino game; receiving information for a user's brain activity from a brain activity monitoring device; determining whether at least one component of the user's brain activity exceeds a threshold level; and changing a chance of winning the round of play if the at least one components of the user's brain activity exceeds the threshold level.

The following detailed description and accompanying drawings provide a better understanding of the nature and advantages of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a simplified schematic of a game system according to one embodiment.

FIG. **2**A is a simplified image of a user interface for the above described slot machine game according to one embodiment.

FIG. **2**B is a simplified image of a user interface for a roulette game according to one embodiment.

FIG. **2**C is a simplified image of a user interface for an electronic casino war game according to one embodiment.

FIG. **2**D is a simplified image of a user interface for a blackjack game according to one embodiment.

FIG. **3** is a high-level flow diagram of a method of play of a casino game according to one embodiment.

FIG. **4** is a simplified image of a user interface that may be displayed for an electronic poker game where the user interface is for one of the users playing the game and the user interface includes information for each user's brain activity.

DETAILED DESCRIPTION OF THE INVENTION

Embodiments of the present invention provide a method, a game system, and a computer program product for electronic gaming and process management for an electronic game by monitoring and utilizing brain actively for game control.

Brain Activity

Brain activity of humans can be monitored to identify recognizable states of consciousness. More specifically, brain activity can be monitored via the detection of relatively low frequency electrical waves that occur in the brain. A variety of devices are configured to detect these low frequency electrical waves, such as electroencephalography (EEG) machines and magnetoencephalography (MEG) machines.

Alpha waves, for example, are one type of brain wave (e.g., out of five brain waves) that can be detected by EEG and MEG machines. Alpha waves are indicators of a state of relaxation of a person who is awake. Alpha waves have an oscillation frequency of about 8-12 hertz and predominantly originate from the occipital lobe during wakeful relaxation. An alpha-like variant wave called the mu wave can also be detected by EEG and MEG machines. Mu waves have an oscillation frequency of about 8-13 hertz and are found over the motor cortex and are associated with movement. Specifically, mu waves are associated with changes in movement, such as movement reduction, and with the intention to move.

EEG and MEG machines may also detect other brain waves, such as beta waves that propagate in the brain at about 12 and 30 Hz. Beta waves are the states associated with normal waking consciousness, such as active, busy, or anxious thinking and active concentration. Beta waves are further associated with the muscle contractions that happen in isotonic movements and are suppressed prior to and during movement changes. The intensity of beta waves may increase when movement has to be resisted or voluntarily suppressed. Beta waves also propagate over the motor cortex.

Embodiments of a game system descried herein are configured to detect such brain activity (e.g., alpha, beta, and mu waves) and utilize the detected brain activity to control an electronic game, such as a casino style electronic game that is configured to operate on a game system. For example, embodiments of the game system described herein are configured to detector one or more brain's waves, such as all of the brains waves, such as the alpha waves, the beta waves, the delta wave, the mu waves, and the theta waves. Game systems of the present invention may also analyze (e.g., apply one or more mathematical functions to) one or more the detected brain wave individually or cumulatively to provide one or more summaries of brain activity (sometimes referred to as a state of the brain).

Game System

FIG. **1** is a simplified schematic of a game system **100** according to one embodiment. Game system **100** may include one or more of a variety of game devices **102** on which an electronic game can be played, such as a computer (e.g., a desktop computer, a laptop computer, a tablet computer, or the like), a gaming console, or a mobile device (such as a mobile device dedicated to game play or configured to perform additional functions, such as smart phone functions). This list of game devices is not exclusive and embodiments of the present invention may include other game devices.

Game device **102** may also include a processor **105**, a memory **110**, a display **115**, a graphics accelerator, **120**, a brain monitoring module **125** having a port **125***a* for external communication, an audio system **130**, a network interface device **135**, a set of human interface devices **145***a*, and a power source **150**. A set as referred to herein includes one or more elements. For example, the set of human interface devices **145***a* may include one or more human interface devices. Different implementations of gaming device **100** may include any number of the listed components, in any combination or configuration, and may also include other components not shown.

The foregoing listed components of game device **102** may be linked together via a bus **155**, which may be the system bus architecture of gaming device **102**. Although this figure shows one bus that connects the components, the busing is illustrative of any interconnection scheme serving to link these components or other components included in gaming device's **102** subsystems. For example, the audio system **130** could be connected to a subsystem through a port or have an internal direct connection to processor **105**.

Game device **102** may be an integrated system where the listed components are housed substantially in a single housing, or may be a modular system. For example, while display **115** is shown in FIG. **1** as being included in game device **102**, the display might be an external device, such as a stand-alone computer monitor or television device. According to another example, while game system **100** is shown as including human interface devices **145***a* integrated with game device **102**, the human interface devices might be external devices (e.g., human interface devices **145***b*), or might be a combination of integrated and external human interface devices. External human interface devices **145***b* may be configured to wire or wirelessly connect to game device **102**.

Processor **105** may include a microprocessor, a microcontroller, control logic, a multi-core processor, or the like. Memory **110** may include a variety of memories, such as a volatile memory **110***a* (e.g., a RAM), a non-volatile memory **110***b* (e.g., a disk, Flash, PROM, etc.). Non-volatile memories are sometimes referred to as non-transitory memories. One or more non-transitory memories of game device **102** may store computer code for an electronic casino game **165**, such as an electronic casino game. Power source **150** can be an AC source, a battery, such as a disposable battery, or both. Different implementations of tissue oximetry device **100** may include any number of the listed components, in any combination or configuration, and may also include other components not shown.

The sets of human interface devices **145***a* and **145***b* may include one or more of a variety of devices. For example, the sets of human interface devices **145***a* and **145***b* may include a computer mouse, a keyboard, a touchpad, a blink monitor for monitoring whether a user's eye has blinked, a joystick, a steering wheel, or the like. If display **115** is a touch screen, then the display may operate as one of the human interface devices as is common with mobile game devices.

Network interface device **135** may include one or more of a variety of wired or wireless interfaces configured to communicate via a variety of communication protocols with

external devices and external networks, such as the Internet, intranets, home networks, personal networks, or the like.

Brain Activity Monitoring

Game device **102** may include or may be configured to connect (wire or wirelessly) to a brain activity monitoring device **140** of game system **100**. Brain activity monitoring device **140** is configured to monitor the brain activity of a user of game device **100**. Specifically, brain activity monitoring device **140** may be configured to monitor a user's brain activity, such as a user's alpha waves, beta waves, mu waves, or the like.

Brain activity monitoring device **140** may be configured to generate and output a "brain" signal (analog or digital) that includes information for the user's brain activity. The brain signal may include: i) unprocessed (i.e., raw) information for the user's brain activity detected by one or more detectors (e.g., electrodes), which are included in brain activity monitoring device **140**, ii) processed information of the user's brain activity, or iii) a combination of unprocessed and processed information. The unprocessed information may include information for the user's brain waves. For example, the unprocessed information may include information for a variety of brain waves, such as information for the intensity of the user's alpha waves, beta waves, delta waves, gamma wave, mu waves, theta waves, and the like.

Brain activity monitoring device **140** may be configured to process the unprocessed information collected from a user's brain according to one or more algorithms that are configured to provide an interpretation of a user's brain waves. The processed information may include information regarding general brain states, such as indexed information for levels of brain relaxation, brain focus, brain familiarity, brain anxiety, or the like.

Brain monitoring port **125***a* may be configured to receive the brain signal from brain activity monitoring device **140**, and transfer the brain signal to brain monitoring module **125**. Brain monitoring module **125** may be configured to analyze the brain signal and utilize the brain signals to control various aspects of electronic casino game **165**, which may be operating on game device **102**. According to one implementation, brain monitoring module **125** is configured to compare the received brain signal and to one or more threshold brain activity levels **160** for controlling the electronic casino game. Control of the electronic casino game via the utilization of brain signals is described in further detail below. Information for the threshold brain activity levels **160** may be stored in memory **110** and retrieved by brain monitoring module **125** for controlling the electronic casino game

Brain activity monitoring device **140** may be the MindSet™, the MindWave™, or the MindWave Mobile™ brain activity monitoring device of NeuroSky, Inc. of San Jose, Calif.; the Muse™ brain activity monitoring device of Interaxon, Inc. of Toronto Ontario; or the EPOC™ of Emotiv, Inc. of San Francisco, Calif. The foregoing list of brain activity monitoring devices is not inclusive and other brain activity monitoring devices may be used with embodiments of the present invention.

Electronic Casino Games

In one implementation, electronic casino game **165** includes one or more game attributes that can be controlled by a user controlling and changing her brain activity, such as controlling and changing the intensity of her brain waves. As described above, brain activity monitoring device **140** may detect the user's brain activity (e.g., alpha wave intensity) as the user controls and changes her brain activity, and may generate the brain signal based on the detection of the user brain activity. The brain activity monitoring device may transmit the brain signal to the electronic casino game where the electronic casino game uses the brain signal for controlling one or more game attributes.

Electronic casino game **165** may substantially continuously monitor the received brain signal and change one or more game attributes of the electronic game based on the brain signal, such as based on changes in the brain signal. For example, the electronic casino game may be configured to monitor a portion or all (unprocessed or processed) of the brain signal associated with the user's brain waves (such as five, six, seven, eight, or more of the user's brain waves) and change one or more game attributes as the intensity of the user's say alpha waves (relative to the other four or five waves) increase or decrease as indicated by the brain signal. The user might increase the intensity of her alpha waves (or any combination of her other brain waves), for example, by controlling and increasing a sense of relaxation of her mind, body, or both.

According to another example, the electronic game may be configured to monitor a portion (unprocessed or processed) of the brain signal associated with the user's beta waves and change a game attribute as the intensity of the user's beta waves increase or decrease as indicated by the brain signal. The user might increase the intensity of her beta waves (or any combination of her other waves), for example, by controlling and increasing a sense of active concentration.

According to another example, the electronic casino game might monitor a portion of the brain signal that indicates the user's familiarity with a task (i.e., task familiarity), the difficulty a user experiences in performing a task, the user's state of alertness, or the like. The foregoing description provides specific examples of information included in the brain signal that may be monitored and utilized by the electronic casino game for controlling game attributes. However, the foregoing description does not limit the information included in the brain signal, and does not limit the information in the brain signal that the electronic casino game may monitor and utilize for game control. The electronic casino game may monitor information in the brain signal related to brain activity, such as alpha waves, beta waves, delta waves, gamma waves, mu waves, theta waves, or the like. It is noted that while a number of different types of brain waves are discussed herein, the brain activity monitoring device might monitor one or more (e.g., all) of these wave or other brain waves. It will be understood by those of skill in the art that brain waves are sometimes divided into other sets of frequencies and labels with other brain wave identifiers.

Game Attributes

A game attribute of the electronic casino game might be an attribute that the electronic casino game provides a user output for (e.g., via processor **105**) on display **115**, on audio system **130**, on a human interface device **145***a* or **145***b* (e.g., that is configured to provide tactile feedback), or a combination of the foregoing components. As such, a user of the electronic casino game can visually, audibly, or tactilely perceive changing the game attribute as the user controls and changes her brain activity. That is, the user is provided feedback of her brain activity (sometimes referred to as neurofeedback) and whether she is changing her brain activity based on the user output from the electronic casino game.

According to one implementation, the electronic casino game is configured to provide a game reward if the user controls (e.g., maintains or changes) her brain activity in a predetermined manner where the electronic casino game can determine whether the user's brain activity has changed, for example, in the predetermine manner by monitoring and analyzing the brain signal.

For example, the electronic casino game may provide a game reward if the user maintains the intensity of one or more of her brain waves within a given range or at a relatively constant level, such as substantially maintaining the intensity of her alpha waves while she plays the electronic casino game. Alternatively, the electronic casino game may provide a game reward if the user changes the intensity of one or more of her brain waves, such as increasing the intensity of her alpha waves by relaxing her mind, body, or both while she plays the electronic casino game. Game rewards are well understood in the art and specific example of game rewards are described below.

According to one embodiment, the electronic casino game is an electronic slot machine type of game, an electronic poker type of game, or the like. The slot machine game may provide a game reward if the user changes her brain wave intensities in a first manner (e.g., for alertness, for relaxation of her mind or body, or a combination thereof) as the user plays the slot machine game. For example, the slot machine game may provide the game reward if the user increases her brain wave intensities for alertness, for relaxation of her mind or body, or a combination thereof. The slot machine game may provide a game detriment if the user lowers her brain wave intensities for alertness, for relaxation of her mind or body, or a combination thereof.

According to one implementation, the game reward provided by the slot machine game may include slowing the "rotation" rate of the slot wheels that are displayed on display **115**, and the game detriment may include increasing the rotation rate of the slot wheels. At the beginning of a round of play of the slot machine game, the rotation rate of the slot wheel may be a predetermined rate that can be raised or lowered based on the user's detected brain waves as described above. With the rotation rate of the slot wheels lowered, the slot machine game provides the user with an increased chance of stopping the slot wheels in a winning configuration. That is, with the rotation rate of the slot wheels lowered, the user can more easily determine whether game symbols that are currently showing on the rotating slot wheels should be stopped on, or not stopped on, to achieve a winning configuration of the game symbols. In contrast, with the rotation rate of the slot wheels increased, the user may not be able to easily determine whether the game symbols that are currently showing should be stopped on or not to achieve a winning configuration. In brief overview, if the user controls her brain waves to slow the rotation rate of the slot wheels, then sees that the rotation rate of the slot wheels is lowered and can see game symbols for a winning configuration, then the user may have an increased chance of winning a round of play the slot machine game.

In the round of play of the slot machine game, the slot wheels may be stopped one or more at a time. The slot wheels may be stopped based on the detection of a user action. Brain activity monitoring device **140**, one or more of the human interface devices **145***a* or **145***b*, or both may be configured to detect a user action for stopping the rotation of the slot wheels (e.g., one or more at a time). According to one specific embodiment, brain activity monitoring device **140** includes a blink detector **142** that is configured to detect the blinking of the user's eyes. Brain activity monitoring device **140** may transmit a control signal to brain monitoring port **125***a*, where the control signal includes blink information that indicates whether the user has blinked her eyes. Brain monitoring module **125** may use the control signal to determine the user has blinked her eyes and control the slot machine game to stop one or more of the slot wheels based on whether the user has blinked her eyes. After a round of the slot machine game has been played, another round of the slot machine game may be started via detection of a user input by brain activity monitoring device **140** (e.g., an eye blink), or by one or more of the human interface devices **145***a* or **145***b*.

FIG. **2**A is a simplified image of a user interface for the above described slot machine game according to one embodiment. The user interface includes a number of slot wheels **167** (e.g., three shot wheels **167***a*, **167***b*, and **167***c*) that are configured to rotate on display **115**. As described above, the rotation rate of the slot wheel may be increased or decreased based on the user's brain activity. According to one implementation, the user interface may also include an indicator **170** that indicates a level of the particular brain activity that the slot machine game is monitoring for use in changing the rotation rate of the slot wheels. The user interface may include a set of screen buttons or the like for controlling various aspects of the slot machine game, such as making bets, checking the user's balance, and the like.

According to one embedment, the electronic casino game may utilize a number of threshold levels (or ranges) for a user brain activity to determine whether to provide a game benefit (i.e., change a game attribute to increase the user's chances of winning a round of play), leave the game unchanged (i.e., not change the game attribute thereby leaving the user's chances of winning the round of play unchanged), or provide a game detriment (i.e., change the game attribute to decrease the user's chances of winning the round of play). For example, a first threshold level may be utilized for increasing the chances of winning a round of play, and a second threshold level (e.g., that is below the first threshold level) may be utilized for determining whether a game detriment will be provided. If the brain activity level is between the first and the second threshold levels, then neither a game benefit nor a game detriment may be provided.

According to one implementation, the electronic casino game utilizes the brain signal to substantially continuously change a game attribute. For example, if a portion of the brain signal is above a threshold level, and the brain signal changes substantially continuously as the user's brain activity changes, the electronic casino game may change the game attribute in a substantially continuous manner as the brain signal changes. For example, if the electronic casino game is the slot machine game, the rotation rate of the slot wheels may be substantially continuously and smoothly transitioned between rotation rates.

According to one implementation, the electronic casino game does not provide game detriments based on the user brain activity. For example, electronic casino games that have relatively low return percentages (i.e., percentage of bet made) for winning a round of play might not provide game detriments. For example, an electronic slot machine game that has a relatively low return percentage might not increase the rotation rate of the slot wheels if the user's brain activity falls below a threshold level for brain activity. In contract, an electronic slot machine game that has a relatively high return percentage might increase the rotation rate of the slot wheels if the user's brain activity falls below the threshold level for brain activity.

While the example embodiments described above are directed to a slot machine game, embodiments of the present invention may include other electronic casino games that present information on a display or the like at a given rate, wherein the given rate may be changed to increase or decrease the chance of winning a round of play. For example, the electronic casino game may be an electronic roulette game where the rotation rate of the roulette wheel may be decreased as a game benefit to increase the chance of winning a round of

play, or may be increased to decrease the chance of winning FIG. **2**B is a simplified image of a user interface for a roulette game according to one embodiment where a rotation rate of a roulette wheel **250** may be increased to provide a game benefit or lowered to provide a game detriment based on a user's brain activity as described above. The user interface for the roulette game may also include indicator **170** that indicates a level of the particular brain activity that the roulette game is monitoring for use in changing the rotation rate of the roulette wheel. The user interface may also include a set of screen buttons or the like for controlling various aspects of the roulette game, such as making bets, checking the user's balance, and the like.

Another embodiment of an electronic casino game in which information is presented to a user at a given rate is an electronic war game where cards that might be dealt to a user may be presented to a user a given rate, and the user can lower the given rate by controlling or changing her brain activity, or the given rate might be increased if the user is not successful in controlling or changing her brain activity in the manner expected by the electronic war game. FIG. **2**C is a simplified image of a user interface for an electronic war game according to one embodiment where a presentation rate of cards **260** that might be dealt to a user may be increased to provide a game benefit or lowered to provide a game detriment based on a user's brain activity as described above.

Specifically, the electronic war game may display the faces of cards **260** that may be dealt to the user on display **115**. Each card may be displayed for a relatively short period of time, such that at the rate at which the cards are displayed, the reaction time of the user may not be sufficient to guarantee that the user can select a specific card that the user would like dealt.

The electronic war game operating in conjunction with brain activity monitoring device **140** (as described above with respect to the slot machine game) may monitor the user's brain activity and provide a game option for increasing the length of times that the faces of the cards are displayed so that the user's chance of selecting the card being displayed increases. The length of time the face of a card is displayed may be increased by the user controlling and changing the user's brain activity as described above. For example, the electronic war game may require that the user increase her sense of relaxation by increasing the intensity of the user's alpha waves (or a combination of brain waves), and increase the amount of time the face of a card is displayed as the user's sense of relaxation increases. The electronic war game may allow the user to select a card displayed by a variety of method, such as those descried above with respect to the slot machine game (e.g., eye blink detection or the like).

The user interface for the electronic war game may also include indicator **170** that indicates a level of the particular brain activity that the electronic war game is monitoring for use in changing the presentation rate of cards **260**. The user interface may also include a set of screen buttons or the like for controlling various aspects of the electronic war game, such as making bets, checking the user's balance, and the like.

Another embodiment of an electronic casino game in which information is presented to a user at a given rate is an electronic blackjack game where cards that might be dealt to a user may be presented to a user a given rate, and the user can lower the given rate by controlling or changing her brain activity, or the given rate might be increased is the user is not successful in controlling or changing her brain activity in the manner expected by the electronic blackjack game. The control of the rate of cards being presented is substantially similar to the control of the rate of cards being presented as described above with respect to the electronic war game. FIG. **2**D is a simplified image of a user interface for a blackjack game according to one embodiment where a presentation rate of cards **270** that might be dealt to a user may be increased to provide a game benefit or lowered to provide a game detriment based on a user's brain activity as described above.

The user interface for the electronic blackjack game may also include indicator **170** that indicates a level of the particular brain activity that the roulette game is monitoring for use in changing the rotation rate of the roulette wheel. The user interface may also include a set of screen buttons or the like for controlling various aspects of the electronic war game, such as making bets, checking the user's balance, and the like.

FIG. **3** is a high-level flow diagram of a method of play of a casino game according to one embodiment. The high-level flow diagram represents one example embodiment. Steps may be added to, removed from, or combined in the high-level flow diagram without deviating from the scope of the embodiment.

At **300**, a round of play of the electronic casino game is started, for example, via a user input received by game device **102**. The user input may be received by the game device from brain activity monitoring device **140**, by one of human interface devices **140***a* or **140***b*, or the like. At **305**, brain activity monitoring device **140** monitors the user's brain activity and generates a brain signal based on the detected brain activity. At **310**, the electronic casino games compares brain activity information in the brain signal to a threshold level of brain activity to determine whether the brain activity information is at or above the threshold level, or is below the threshold level. For a multiplayer game where multiple users are using the electronic casino game, the brain activity of multiple users may be compared to one or more threshold levels At **315**, the electronic casino game provides a game benefit if the brain activity information is at or above the threshold level. That is, the electronic casino game changes a game attribute to increase the user's chance of winning the round of play that is currently being played. The electronic casino game may provide a user output that indicates the change to the game attribute (i.e., increasing the rotation rate of slot wheels where the rotation rate may be detected by the user) so that the user can monitor and control of the game attribute by controlling and changing her brain activity. At **320**, the electronic casino game may provide a game detriment or leave the game unchanged if the electronic casino game determines that the brain activity information is below the threshold level. At **325**, game device **102** receives a user input (e.g., a detected eye blink) from the user for selecting a game option based on the game attribute. The game option may be for stopping the round of play (e.g., stop all of the slot wheels) based on the game attribute (e.g., slowed slot wheels). Alternatively, the game option (stopping one slot wheel) might be included in a set of game options where other game options included in the set of game options may be selected by the user at a later time (e.g., stopping other rotating slot wheels at a later time). At **330**, the electronic casino game provides a user output that indicates the user's selection of the game option (e.g., display the stopping or one or more of the slot wheels on display **115**). Thereafter, if the round of the game is still being played (e.g., the other slot wheels are still rotating), then steps **305**-**330** may be repeated until the round of play has stopped.

According to one alternative embodiment, at step **310** where the electronic casino game is a multiplayer game and multiple users might be using the electronic casino game, then the brain activity of the multiple users may be monitored and may be compared to one or more threshold levels. Then at step **315**, a game detriment might be applied if an opponent's

brain activity is below the threshold level, and a game benefit might be applied is the opponent's brain activity is above the threshold level, alternative step **320**. At **325**, multiple game devices of the multiple users may receive user inputs from the respective users for selecting one or more game options based on various game attributes provided to the users.

Electronic Casino Game with Displayed Brain Signals

One implementation of an electronic casino game provides one or more user outputs for one or more pieces of information (e.g., for brain activity) that may be included in the brain signal. The information for the one or more brain activities may be provided via display **115**, via audio system **130**, or via tactile feedback from one or more of human interface devices **145***a*, **145***b*, or a combination thereof. The information can be used by a user to make decisions for playing the electronic casino game. For example, in a multiplayer electronic casino game where two or more users are playing the electronic casino game against one another, information for each user's brain activity might be displayed on each user's display **115**. For a multiplayer electronic casino game, each user may use her own game device **102** to play the electronic casino game across a network (e.g., the Internet, intranet, or the like). Each user may use the displayed information to determine how to make plays in the electronic casino game based on their own brain activity and the other users' brain activity. For example, for an electronic poker game, one user might determine that a second user is experiencing brain activity for stress, and the user might make a game decision (e.g., increase a bet, decrease a bet, fold, or the like) based on the second user's stress.

FIG. **4** is a simplified image of a user interface that may be displayed for such an electronic poker game where the user interface is for one of the users playing the game and the user interface includes information **402** for each user's brain activity. The user interfaces of each of the other users playing the electronic poker game may be similarly configured to display the information for each user's brain activity. Each user's brain activity may be identified by a user identifier, such as a user name. The example user interface shown in FIG. **4** may be displayed for the user "JRONE" whose cards are shown facing up. Because each user can see information for every other user's brain activity, including the user's own brain activity, the brain activity of the other users might affect the brain activity of the user interpreting the other users' brain activity. Seeing other users' brain activity is a form of exposing the brain states and emotions of other users (i.e., "tells") based on each of the user's brain activity and can be used as a benefit or detriment in determining a next play to make in the electronic poker game.

The information for each user's brain activity may include one or more pieces of information. For example, the user interface may show information for: i) alertness, ii) relaxation, ii) task difficulty (i.e., information for the difficulty a user's brain is exhibiting while playing), vi) task familiarity (i.e., information for the familiarity a user's brain is exhibiting while playing), or other brain state information that may be included in the brain signal provided by brain activity monitoring device **140**. It is noted that the foregoing list of brain states is not exclusive and that based on the advancements in brain study, new understanding of brain activity are yielding newer algorithms that can provide information for additional brain states based on detected brain waves. Embodiments of the present invention may use known and understood brain states or brain states known at the time. The information for a user's brain activity may be displayed in a variety formats, such as numerically, in one-dimensional bar graphs (e.g., as shown in FIG. **4**), pie charts, or the like.

According to one implementation, brain activity monitoring device **140**, game device **102**, or both may be configured to generate a summary **405** (see FIG. **1**) of a user's brain activity, such as a summary of the information for brain activity included in the brain signal. Methods for generating a summary of brain activity are well known to those of skill in the art, and are not described in details herein. The summary of a user's brain activity may indicate whether the user is feeling stress, calm, excited, or the like. The summary **405** of a user's brain activity may be displayed on the user interface (see FIG. **4**), for example, of a multiplayer game, such as the electronic poker game described above. Users playing the electronic casino game may make decisions for making plays in the electronic casino game based on the summary of another user's brain activity or the user's own summary of brain activity. The information for each user's brain activity and the summaries of the brain activity may be displayed in a variety of electronic casino games where two or more users are playing an electronic casino game against one another.

As briefly described above, physical activity, such as eye blink activity of users, may also be monitored by the electronic poker game. Information for a user's physical activity (e.g., eye blink rate) may be displayed on the user interface of the electronic casino game, and may also be used for generating the summary information for each user's brain activity.

Electronic Casino Game Providing Brain Control and Displayed Brain Signals

According to one embodiment, the electronic casino game: i) is configured for multiplayer use, ii) monitors a user's brain signal (e.g., generated by brain activity monitoring device **140**) and allows a user to attempt to control and change her brain activity to change a game attribute of the electronic casino game, thereby allowing the user to attempt to increase the user's chance of winning the electronic casino game, and iii) provides information for the brain activity of other users who are playing rounds the electronic casino game with the user. For example, the electronic blackjack game may be configured for multiplayer user, and may allow each user to change the user's chances of winning the game by allowing each user to attempt to control the cards dealt to the user as described above with respect to FIG. **2**D.

Further, the electronic blackjack game may display information for the brain activity of each user, and may display a summary of the brain activity of each user. Each user may attempt to interoperate the information for the brain activity and the summary of the brain activity of the other users for making decision for further play in a round of the game, such as increasing a bet, being dealt another card, folding a hand, or other game activity.

In one implementation, the electronic blackjack game assigns the users of the electronic blackjack game in series (for example) to be a dealer for one or more rounds of play. The electronic blackjack game may display information for the brain activity and a summary of brain activity of the dealer. The other users playing a round of the electronic blackjack game against the dealer may attempt to interoperate the information for the dealer's brain activity to decide the plays that the users will make in a round of play.

Embodiments of the invention allow user's of the electronic casino game to increase their chances of winning rounds of play of the game. As such, the users may become engaged with the electronic casino game, and play the game for relatively long periods of time trying to win numerous rounds of the games, which may be beneficial to a gambling business offering the electronic casino game. Additional electronic casino games that may be configured to change a game attribute based on brain activity, display information for at

least a portion of the brain activity, or both, may include baccarat, craps, sic bo, and the like.

This description of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form described, and many modifications and variations are possible in light of the teaching above. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications. This description will enable others skilled in the art to best utilize and practice the invention in various embodiments and with various modifications as are suited to a particular use. The scope of the invention is defined by the following claims.

The invention claimed is:

1. A method comprising:

starting a round of play of an electronic casino game machine; and

during a temporal period when the round of play is being played by the electronic casino game machine:

detecting electromagnetic brainwaves emitted from a brain of a user by an electroencephalography machine that is electronically connected to the electronic casino game machine and that is electrically connected to the user;

transferring electronic information for the detected electromagnetic brainwaves from the electroencephalography machine to the electronic casino game machine for use of the electronic information for the detected electromagnetic brainwaves outside of the electroencephalography machine by the electronic casino game machine;

transforming the electronic information for the electromagnetic brainwaves emitted from the brain of the user and detected by the electroencephalography machine into digital electronic signals that represent the electromagnetic brainwaves;

calculating, by the electronic casino game machine, an intensity of the electromagnetic waves detected by an electroencephalography machine using the digital electronic signals that are digitizations of the electromagnetic brainwaves emitted by the brain of the user;

changing a chance of winning the round of play being played from a first chance of winning to a second chance of winning if the intensity of the electromagnetic waves detected by the electroencephalography machine is greater than a threshold intensity level of electromagnetic waves of brain activity, wherein the threshold intensity level is previously determined, and the second chance of winning is different from the first chance of winning; and

maintaining the chance of winning at the first chance of winning, if the intensity of the electromagnetic waves detected by the electroencephalography machine is less than the threshold intensity level of electromagnetic waves of brain activity, wherein the threshold intensity level is previously determined.

2. The method of claim **1** wherein changing the chance of winning the round of play includes increasing the first chance of winning the round of play to the second chance of winning the round of play, wherein the second chance of winning the round of play is greater than the first chance of winning the round of play.

3. The method of claim **2** further comprising lowering the first chance of winning the round of play to a third chance of winning the round of play if the intensity of the electromagnetic waves detected by the electroencephalography machine equals the threshold intensity level or is below the threshold intensity level, wherein the third chance of winning the round of play is less than the first chance of winning the round of play.

4. The method of claim **2** further comprising lowering the first chance of winning the round of play if the intensity of the electromagnetic waves detected by the electroencephalography machine is below a second threshold intensity level, wherein the first mentioned threshold intensity level is different from the second threshold intensity level.

5. The method of claim **2** wherein changing the chance of winning includes changing a game attribute of the electronic casino game.

6. The method of claim **5** wherein changing the game attribute includes changing a rate of information presented on a display.

7. The method of claim **6** wherein the rate of information includes a rate at which at least one game wheel is presented on the display.

8. The method of claim **7** wherein the at least one game wheel is a slot machine wheel.

9. The method of claim **7** wherein the at least one game wheel is a roulette wheel.

10. The method of claim **6** wherein the rate of information is a rate of presenting cards to be dealt.

11. The method of claim **2** further comprising presenting at least one component of the intensity of the electromagnetic waves detected by the electroencephalography machine on a plurality of displays, wherein the electronic casino game machine is a multiuser electronic casino game machine configured for play by a plurality of users, and the displays are respectively associated with the users using the multiuser electronic casino game machine.

12. The method of claim **11** further comprising presenting at least one component of each of the user's intensity of the electromagnetic waves detected by the electroencephalography machine on the plurality of displays.

13. The method of claim **12** further comprising presenting a summary of the intensity of the electromagnetic waves detected by the electroencephalography machine of each of the users on the plurality of displays.

14. The method of claim **12** wherein the electronic casino game machine is an electronic poker game machine.

15. A non-transitory computer-readable storage medium comprising instructions for operating an electronic casino game machine system, wherein the instructions, when executed, are for controlling the electronic casino game machine system to be configured for:

starting a round of play of an electronic casino game machine;

during a temporal period when the round of play is being played by the electronic casino game machine, detecting electromagnetic brainwaves emitted from a brain of a user by an electroencephalography machine that is electronically connected to the electronic casino game machine and that is electrically connected to the user;

during the temporal period when the round of play is being played by the electronic casino game machine, transferring electronic information for the detected electromagnetic brainwaves from the electroencephalography machine to the electronic casino game machine for use of the electronic information for the detected electromagnetic brainwaves outside of the electroencephalography machine by the electronic casino game machine;

during the temporal period when the round of play is being played by the electronic casino game machine, transforming the electronic information for the electromagnetic brainwaves emitted from the brain of the user and

detected by the electroencephalography machine into digital electronic signals that represent the electromagnetic brainwaves;

during the temporal period when the round of play is being played by the electronic casino game machine, calculating, by the electronic casino game machine, an intensity of the electromagnetic waves detected by an electroencephalography machine using the digital electronic signals that are digitizations of the electromagnetic brainwaves emitted by the brain of the user;

during the temporal period when the round of play is being played by the electronic casino game machine, changing a chance of winning the round of play being played from a first chance of winning to a second chance of winning if the intensity of the electromagnetic waves detected by the electroencephalography machine is greater than a threshold intensity level of electromagnetic waves of brain activity, wherein the threshold intensity level is previously determined, and the second chance of winning is different from the first chance of winning; and

during the temporal period when the round of play is being played by the electronic casino game machine, maintaining the chance of winning at the first chance of winning, if the intensity of the electromagnetic waves detected by the electroencephalography machine is less than the threshold intensity level of electromagnetic waves of brain activity, wherein the threshold intensity level is previously determined.

16. The non-transitory computer-readable storage medium of claim **15** wherein changing the chance of winning the round of play includes increasing the first chance of winning the round of play to the second chance of winning the round of play, wherein the second chance of winning the round of play is greater than the first chance of winning the round of play.

17. The non-transitory computer-readable storage medium of claim **16** further comprising lowering the first chance of winning the round of play to a third chance of winning the round of play if the intensity of the electromagnetic waves detected by the electroencephalography machine equals the threshold intensity level or is below the threshold intensity level, wherein the third chance of winning the round of play is less than the first chance of winning the round of play.

18. The non-transitory computer-readable storage medium of claim **16** further comprising lowering the first chance of winning the round of play if the intensity of the electromagnetic waves detected by the electroencephalography machine is below a second threshold intensity level, wherein the first mentioned threshold intensity level is different from the second threshold intensity level.

19. The non-transitory computer-readable storage medium of claim **16** wherein changing the chance of winning includes changing a game attribute of the electronic casino game.

20. The non-transitory computer-readable storage medium of claim **19** wherein changing the game attribute includes changing a rate of information presented on a display.

21. The non-transitory computer-readable storage medium of claim **20** wherein the rate of information includes a rate at which at least one game wheel is presented on the display.

22. A system comprising:

an electronic casino gaming machine comprising:

a processor; and

a computer-readable storage medium comprises instructions for controlling the processor to be configured for starting a round of play of the electronic casino game machine; and

an electroencephalography machine that is electronically connected to the electronic casino game machine adapted for:

during a temporal period when the round of play is being played by the electronic casino game machine, detecting electromagnetic brainwaves emitted from a brain of the user using an electroencephalography machine that is electronically connected to the electronic casino game machine and that is electrically connected to a user;

during a temporal period when the round of play is being played by the electronic casino game machine, transforming the electronic information for the electromagnetic brainwaves emitted from the brain of the user and detected by the electroencephalography machine into electronic signals that represent the electromagnetic brainwaves; and

during the temporal period when the round of play is being played by the electronic casino game machine, transferring the electronic signals for the detected electromagnetic brainwaves from the electroencephalography machine to the electronic casino game machine for use of the electronic signals for the detected electromagnetic brainwaves outside of the electroencephalography machine by the electronic casino game machine,

wherein the computer-readable storage medium comprises instructions for controlling the processor to be configured for:

during the temporal period when the round of play is being played by the electronic casino game machine, transforming the electronic signals for the detected electromagnetic brainwaves received from the electroencephalography machine to digital electronic signals for the detected electromagnetic brainwaves;

during the temporal period when the round of play is being played by the electronic casino game machine, calculating, by the electronic casino game machine, an intensity of the electromagnetic waves detected by an electroencephalography machine using the digital electronic signals that are digitizations of the electromagnetic brainwaves emitted by the brain of the user;

during the temporal period when the round of play is being played by the electronic casino game machine, changing a chance of winning the round of play being played from a first chance of winning to a second chance of winning if the intensity of the electromagnetic waves detected by the electroencephalography machine is greater than a threshold intensity level of electromagnetic waves of brain activity, wherein the threshold intensity level is previously determined, and the second chance of winning is different from than the first chance of winning; and

during the temporal period when the round of play is being played by the electronic casino game machine, maintaining the chance of winning at the first chance of winning, if the intensity of the electromagnetic waves detected by the electroencephalography machine is less than the threshold intensity level of electromagnetic waves of brain activity, wherein the threshold intensity level is previously determined.

23. The computing device of claim **22** wherein the instructions for controlling the processor are further configured for changing the chance of winning the round of play includes increasing the first chance of winning the round of play to the second chance of winning the round of play, wherein the second chance of winning the round of play is greater than the first chance of winning the round of play.

24. The computing device of claim **23** wherein the instructions for controlling the processor are further configured for lowering the first chance of winning the round of play to a third chance of winning the round of play if the intensity of the electromagnetic waves detected by the electroencephalography machine equals the threshold intensity level or is below the threshold intensity level, wherein the third chance of winning the round of play is less than the first chance of winning the round of play.

25. The computing device of claim **23** wherein the instructions for controlling the processor are for further lowering the first chance of winning the round of play if the intensity of the electromagnetic waves detected by the electroencephalography machine is below a second threshold intensity level, wherein the first mentioned threshold intensity level is different from the second threshold intensity level.

26. The computing device of claim **23** wherein changing the chance of winning includes changing a game attribute of the electronic casino game.

27. The computing device of claim **26** wherein changing the game attribute includes changing a rate of information presented on a display.

28. The computing device of claim **27** wherein the rate of information includes a rate at which at least one game wheel is presented on the display.

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