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(54) VARIABLE AUDIO PARAMETER SETTING

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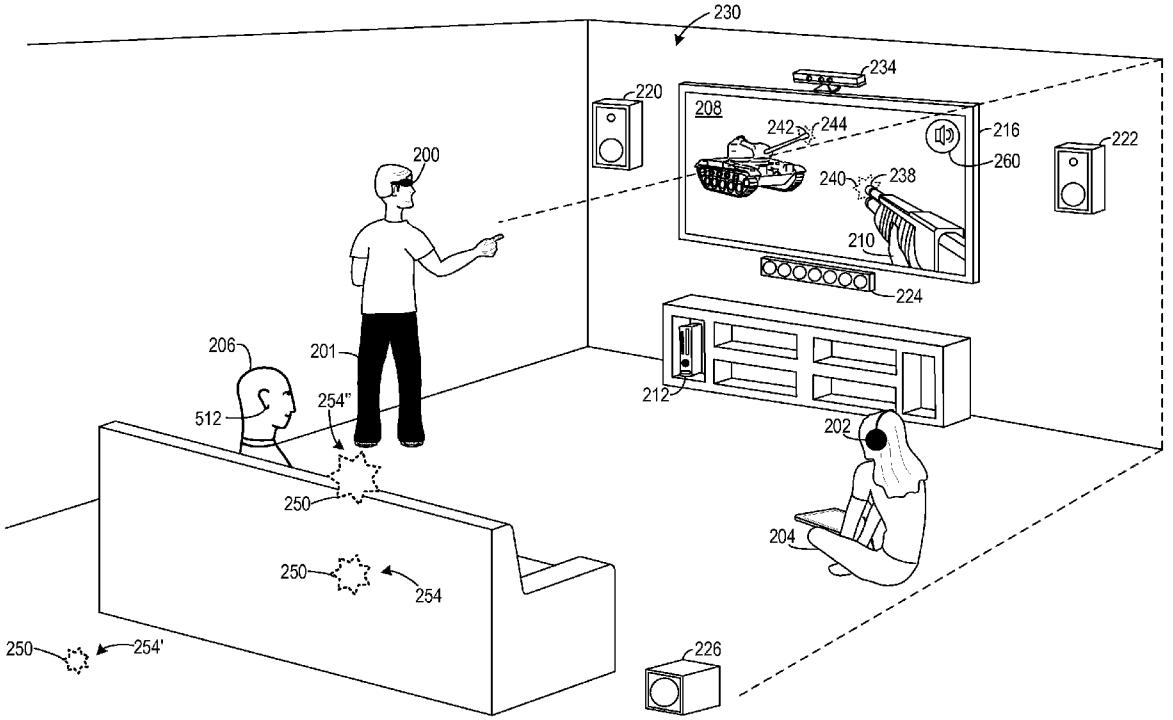
(57) **ABSTRACT**

Various embodiments relating to adjusting a variable audio parameter of a game are provided. In one embodiment, based on a user ability level, a variable audio parameter of the game is adjusted to an adjusted audio parameter that either increases the difficulty level of the game or decreases the difficulty level of the game. The adjusted audio parameter is utilized to provide audio content of the game to a user via an electronic gaming machine.



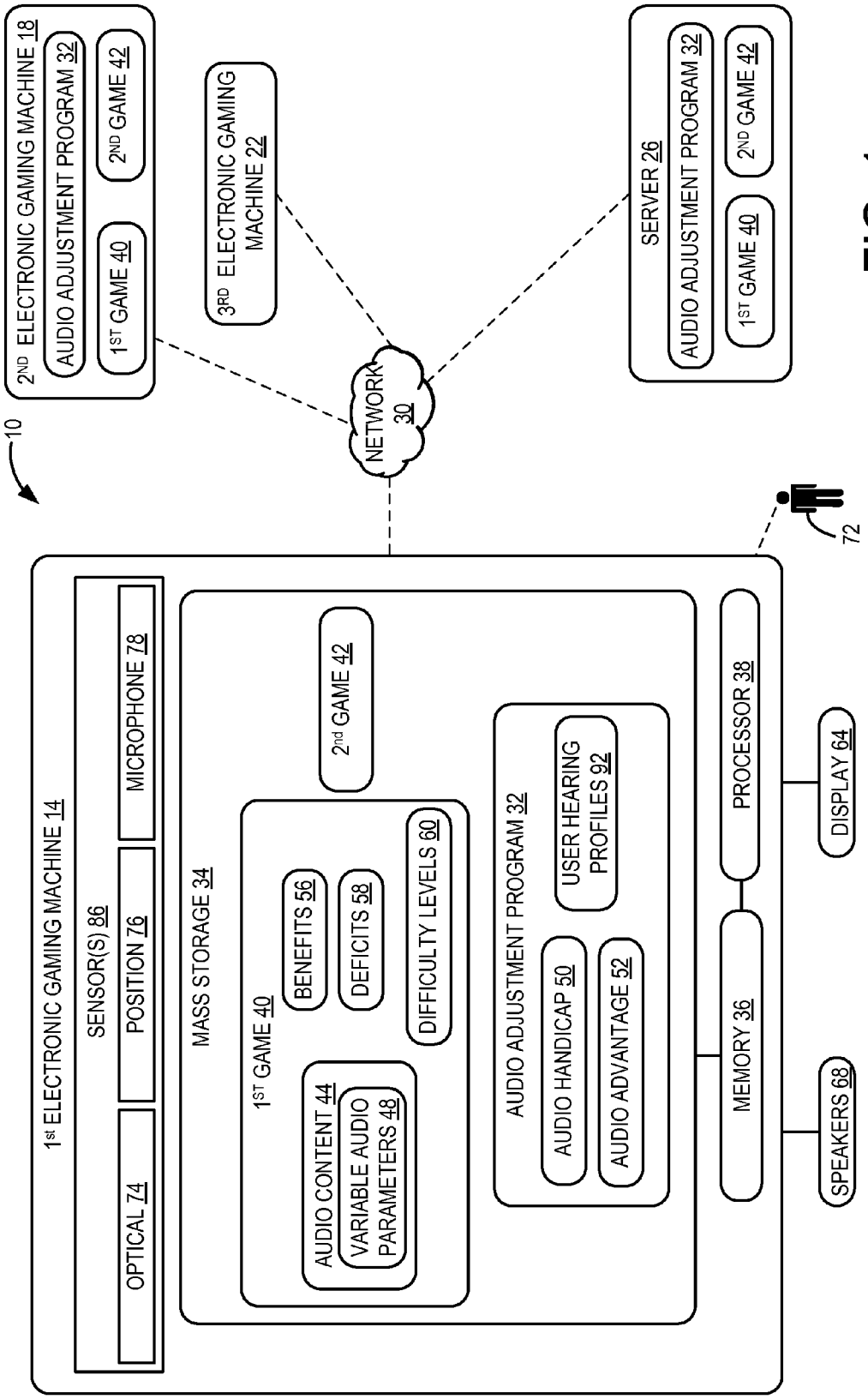

10
2ND ELECTRONIC GAMING MACHINE 18
AUDIO ADJUSTMENT PROGRAM 32
1ST GAME 40
2ND GAME 42
3RD ELECTRONIC GAMING MACHINE 22
NETWORK 30
SERVER 26
AUDIO ADJUSTMENT PROGRAM 32
1ST GAME 40
2ND GAME 42
72
1st ELECTRONIC GAMING MACHINE 14
SENSOR(S) 86
OPTICAL 74
POSITION 76
MICROPHONE 78
MASS STORAGE 34
1ST GAME 40
AUDIO CONTENT 44
VARIABLE AUDIO PARAMETERS 48
BENEFITS 56
DEFICITS 58
DIFFICULTY LEVELS 60
2nd GAME 42
AUDIO ADJUSTMENT PROGRAM 32
AUDIO HANDICAP 50
AUDIO ADVANTAGE 52
USER HEARING PROFILES 92
MEMORY 36
PROCESSOR 38
DISPLAY 64
SPEAKERS 68

FIG. 1

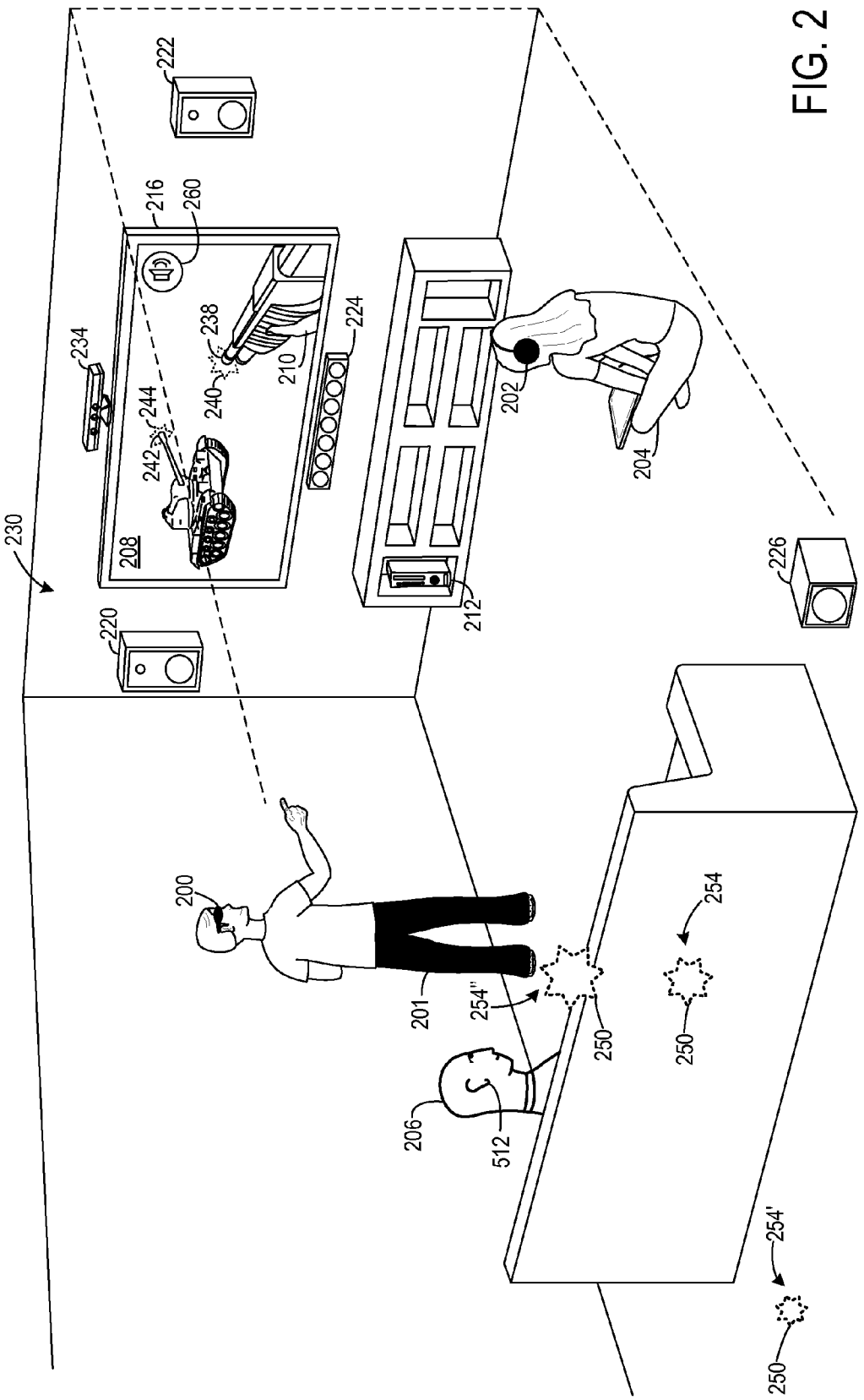

222
216
260
234
238
224
210
240
244
242
208
230
202
204
226
212
220
200
201
254''
250
254
250
206
512
254'
250

FIG. 2

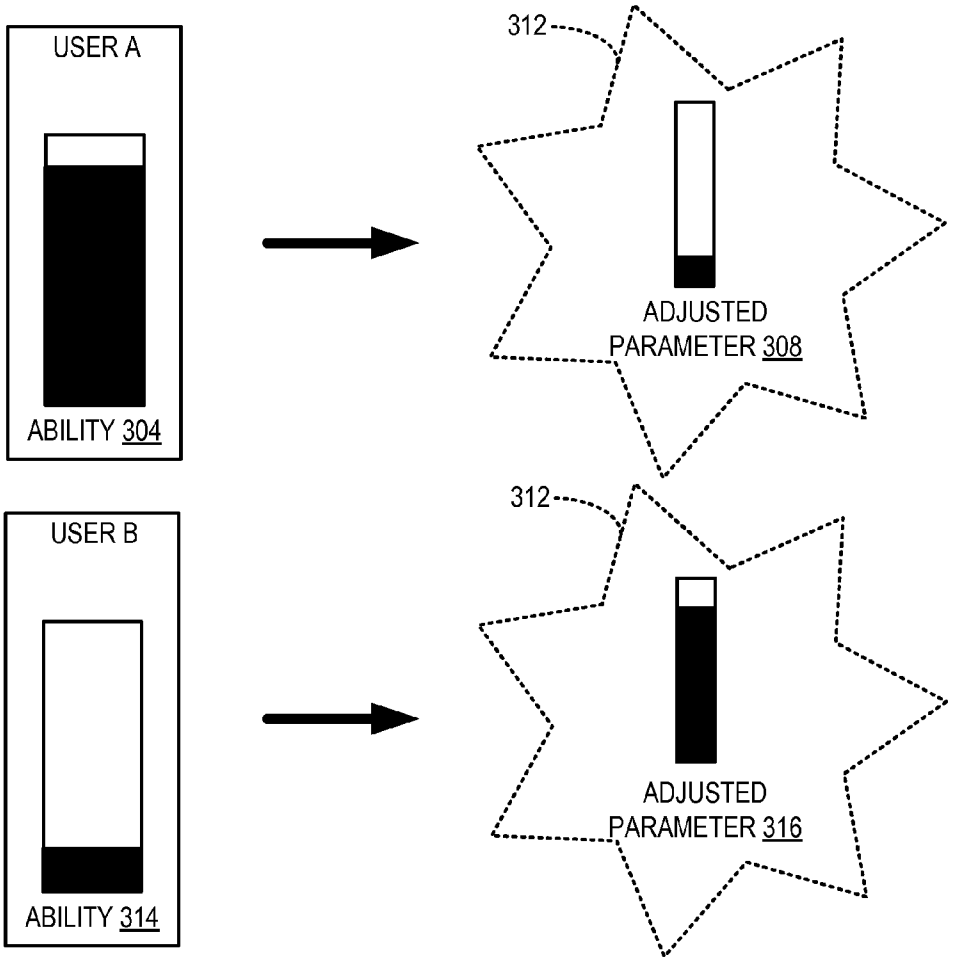

USER A
ABILITY 304
312
ADJUSTED PARAMETER 308
USER B
ABILITY 314
312
ADJUSTED PARAMETER 316

FIG. 3

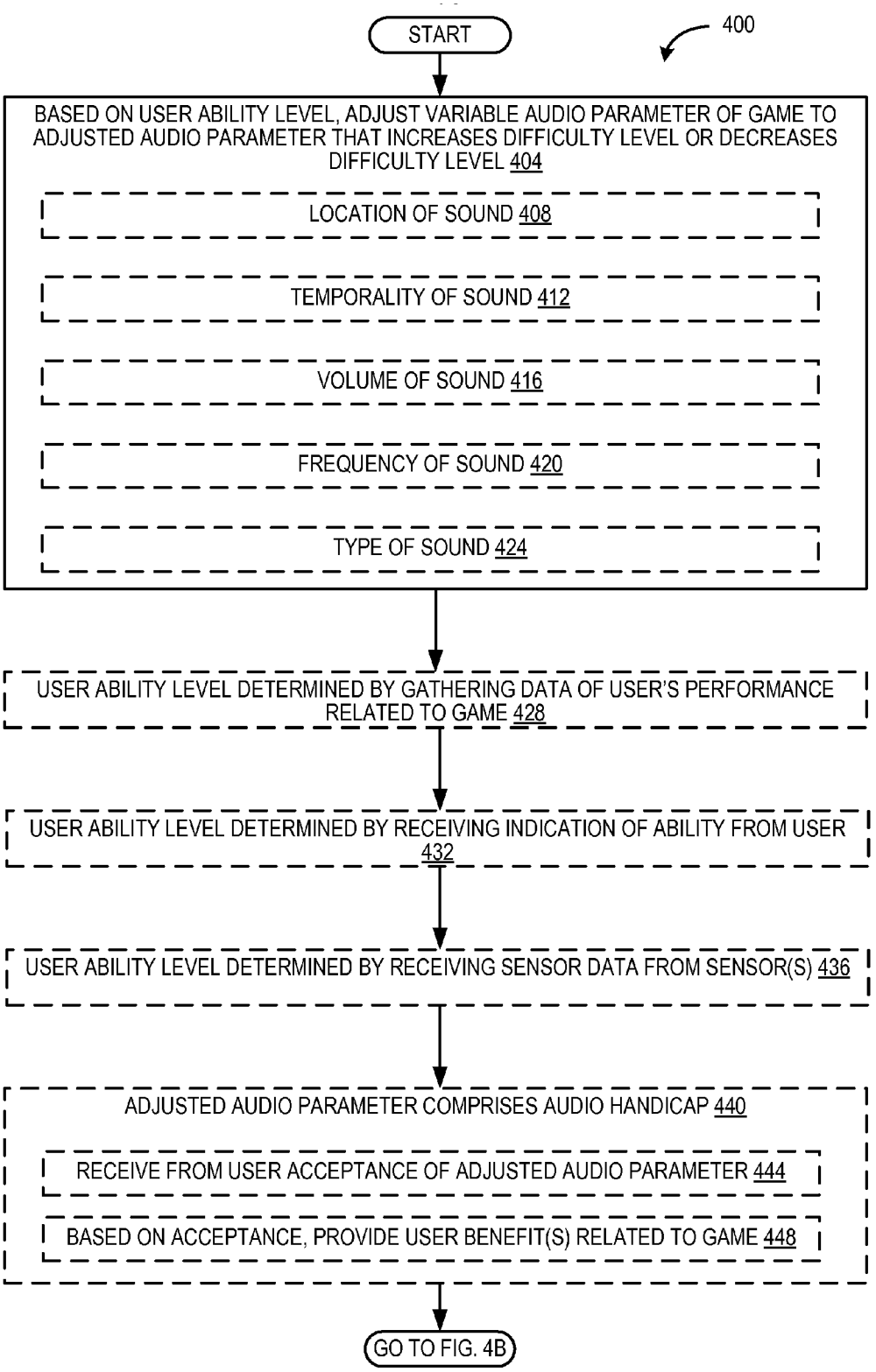

400
START
BASED ON USER ABILITY LEVEL, ADJUST VARIABLE AUDIO PARAMETER OF GAME TO ADJUSTED AUDIO PARAMETER THAT INCREASES DIFFICULTY LEVEL OR DECREASES DIFFICULTY LEVEL 404
LOCATION OF SOUND 408
TEMPORALITY OF SOUND 412
VOLUME OF SOUND 416
FREQUENCY OF SOUND 420
TYPE OF SOUND 424
USER ABILITY LEVEL DETERMINED BY GATHERING DATA OF USER'S PERFORMANCE RELATED TO GAME 428
USER ABILITY LEVEL DETERMINED BY RECEIVING INDICATION OF ABILITY FROM USER 432
USER ABILITY LEVEL DETERMINED BY RECEIVING SENSOR DATA FROM SENSOR(S) 436
ADJUSTED AUDIO PARAMETER COMPRISES AUDIO HANDICAP 440
RECEIVE FROM USER ACCEPTANCE OF ADJUSTED AUDIO PARAMETER 444
BASED ON ACCEPTANCE, PROVIDE USER BENEFIT(S) RELATED TO GAME 448
GO TO FIG. 4B

FIG. 4A

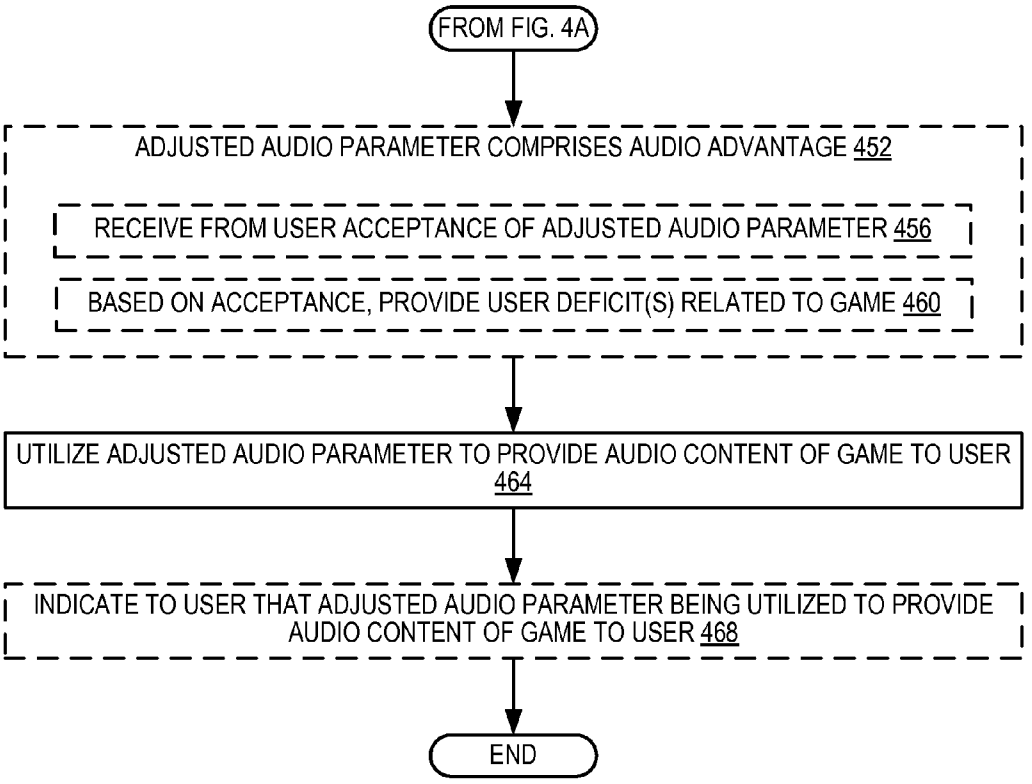

FROM FIG. 4A
ADJUSTED AUDIO PARAMETER COMPRISES AUDIO ADVANTAGE 452
RECEIVE FROM USER ACCEPTANCE OF ADJUSTED AUDIO PARAMETER 456
BASED ON ACCEPTANCE, PROVIDE USER DEFICIT(S) RELATED TO GAME 460
UTILIZE ADJUSTED AUDIO PARAMETER TO PROVIDE AUDIO CONTENT OF GAME TO USER 464
INDICATE TO USER THAT ADJUSTED AUDIO PARAMETER BEING UTILIZED TO PROVIDE AUDIO CONTENT OF GAME TO USER 468
END

FIG. 4B

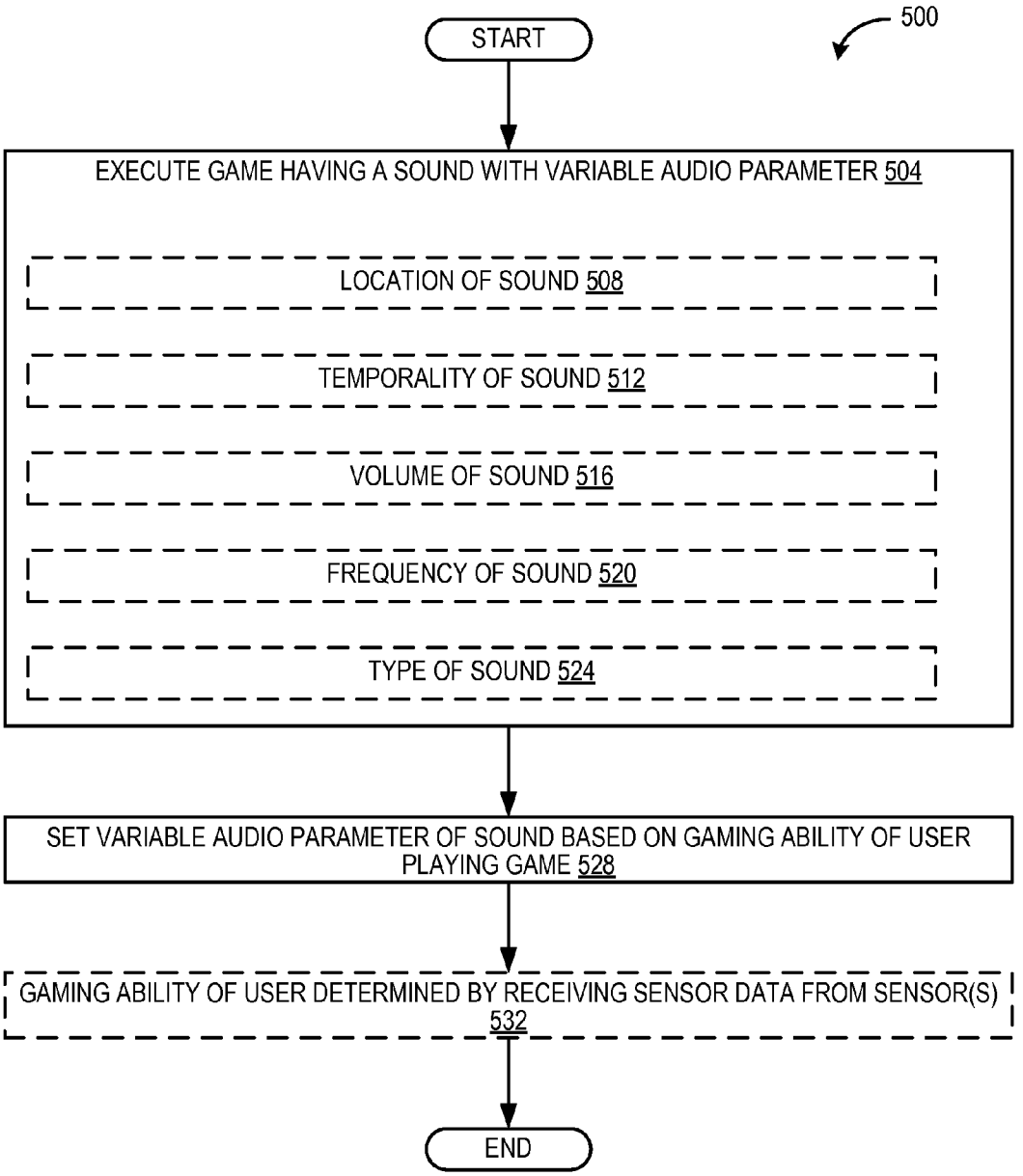

500
START
EXECUTE GAME HAVING A SOUND WITH VARIABLE AUDIO PARAMETER 504
LOCATION OF SOUND 508
TEMPORALITY OF SOUND 512
VOLUME OF SOUND 516
FREQUENCY OF SOUND 520
TYPE OF SOUND 524
SET VARIABLE AUDIO PARAMETER OF SOUND BASED ON GAMING ABILITY OF USER PLAYING GAME 528
GAMING ABILITY OF USER DETERMINED BY RECEIVING SENSOR DATA FROM SENSOR(S) 532
END

FIG. 5

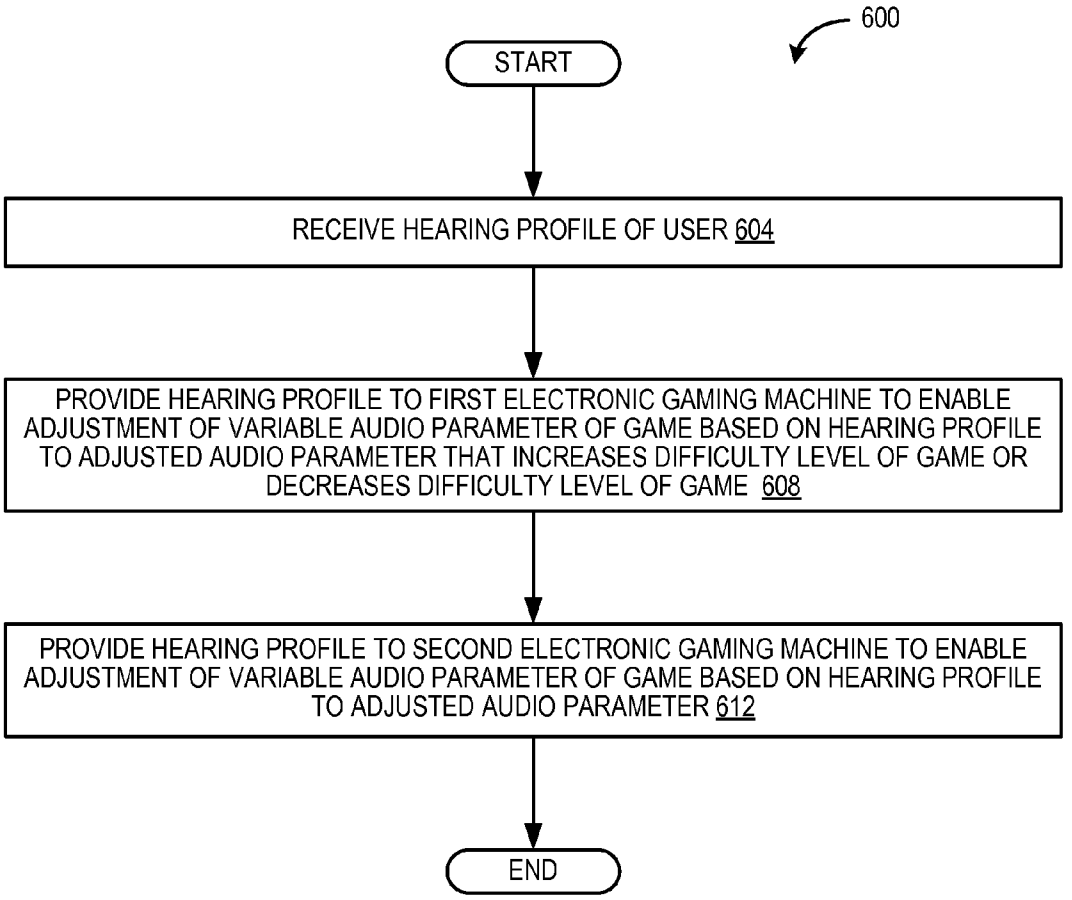

600
START
RECEIVE HEARING PROFILE OF USER 604
PROVIDE HEARING PROFILE TO FIRST ELECTRONIC GAMING MACHINE TO ENABLE ADJUSTMENT OF VARIABLE AUDIO PARAMETER OF GAME BASED ON HEARING PROFILE TO ADJUSTED AUDIO PARAMETER THAT INCREASES DIFFICULTY LEVEL OF GAME OR DECREASES DIFFICULTY LEVEL OF GAME 608
PROVIDE HEARING PROFILE TO SECOND ELECTRONIC GAMING MACHINE TO ENABLE ADJUSTMENT OF VARIABLE AUDIO PARAMETER OF GAME BASED ON HEARING PROFILE TO ADJUSTED AUDIO PARAMETER 612
END

FIG. 6

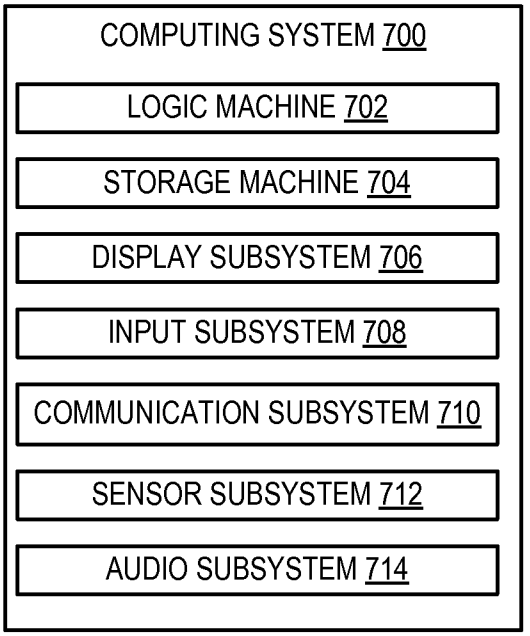

COMPUTING SYSTEM 700
LOGIC MACHINE 702
STORAGE MACHINE 704
DISPLAY SUBSYSTEM 706
INPUT SUBSYSTEM 708
COMMUNICATION SUBSYSTEM 710
SENSOR SUBSYSTEM 712
AUDIO SUBSYSTEM 714

FIG. 7

VARIABLE AUDIO PARAMETER SETTING

BACKGROUND

[0001] Computer games may offer players of varying skill levels multiple levels of difficulty that provide different challenges. Such multiple levels of difficulty are typically implemented via one or more modifications of the visual gameplay experience of the player. For example, such multiple levels of difficulty may be implemented by providing multiple courses or maps having a range of difficulties, restricting access to certain weapons or tools having increased capabilities, enabling in-game adversaries having varying capabilities, enhancing or restricting the capabilities of user on-screen avatars, controlling environmental conditions of a game such as fog effects, lighting effects, etc.

[0002] In multi-player games, issues may arise when multi-player scenarios include players of different skill levels. For example, when a novice player competes against a highly skilled player, a gaming experience at a given difficulty level can be frustrating and less than satisfactory for one or both players. Additionally, providing different difficulty levels for the novice and highly skilled player via visual gameplay modifications in a gaming session can prove challenging.

SUMMARY

[0003] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

[0004] Various embodiments relating to adjusting one or more variable audio parameter of a game are provided. In one embodiment on an electronic gaming machine, a variable audio parameter of a game may be adjusted to an adjusted audio parameter based on a user ability level. The adjusted audio parameter may either increase a difficulty level of the game or decrease a difficulty level of the game. The adjusted audio parameter may then be utilized to provide audio content of the game to a user via the electronic gaming machine.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] FIG. **1** shows a computing system according to an embodiment of the present disclosure.

[0006] FIG. **2** shows a schematic perspective view of a room including users playing a game via electronic gaming machines according to an embodiment of the present disclosure.

[0007] FIG. **3** shows a schematic view of different user ability levels of two users and corresponding adjusted audio parameters according to an embodiment of the present disclosure.

[0008] FIGS. **4**A and **4**B show a method of adjusting a variable audio parameter of a game according to an embodiment of the present disclosure.

[0009] FIG. **5** shows a method of setting a variable audio parameter according to an embodiment of the present disclosure.

[0010] FIG. **6** shows a method of adjusting a variable audio parameter of a game across a plurality of different electronic gaming machines according to an embodiment of the present disclosure.

[0011] FIG. **7** shows a computing system according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0012] This description relates to adjusting one or more variable audio parameters of a game. More particularly, this description relates to an audio parameter adjustment approach that utilizes a user ability level and/or a user hearing ability (referred to herein as a "hearing profile") to generate an adjusted audio parameter. As described in more detail below, a variety of different variable audio parameters may be adjusted to increase or decrease the difficulty level of a game. Audio content of the game may then be provided to a game player using one or more of the variable audio parameters.

[0013] It will be appreciated that many computer games utilize sound in conjunction with visual imagery presented via a display device to create a gaming experience. Humans can discern different intensities or volumes of sounds, different frequencies of sounds, and different types of sounds as corresponding to particular events or phenomena. Humans also have the ability to recognize the source and/or location of a sound (sometimes referred to as "sound localization"), even absent additional (e.g., visual) cues, by comparing aural cues received at both ears. Sound localization may rely on the differences (e.g., time and/or intensity) between the sounds received at both ears, similar to a person's ability to determine visual depth based on the difference(s) in visual information received at each eye.

[0014] It may be desirable in some instances (such as during video game play, for example) to enable a listener of a sound system to perceive that sounds produced by one or more speakers appear to originate at a particular location in three-dimensional acoustic space. In some embodiments, headphones may be utilized to enable the listener to perceive that sounds produced by the headphones originate at a particular location in three-dimensional acoustic space. Typical headphones may comprise, for each ear, one or more acoustic transducers configured to provide audio signals to the ear. Such "three-dimensional audio output" comprises audio output that provides the illusion that sound is coming from a location in three-dimensional acoustic space that may or may not correspond to the location of the speaker(s) producing the sound.

[0015] Other three-dimensional audio systems may utilize a plurality of speakers in order to provide three-dimensional audio effect(s). Such systems may utilize a plurality of speakers positioned near pre-defined locations relative to a user (e.g., front speakers oriented at 30 degrees to the user) and/or rely on the user being located in a particular location in order to provide the desired effect. In other examples, an audio system may utilize audio received at one or more microphones to determine the location of the speakers.

[0016] In contrast to headphones-based systems, loudspeaker-based systems are configured such that audio output from the loudspeakers is detectable by both ears of a human subject. Therefore, additional processing may be utilized to control the audio perceived by each ear, and thus to control the three-dimensional audio effect. For example, systems may utilize one or more "crosstalk cancellation" mechanisms configured such that a first audio signal (e.g., left channel) is

delivered to a first ear (e.g., left ear) and a second audio signal (e.g., right channel) is delivered to a second ear (e.g., right ear) while substantially attenuating the delivery of the first audio signal to the second ear and delivery of the second audio signal to the first ear.

[0017] Regardless of the audio output mechanisms, the provision of three-dimensional audio may be based on a head-related transfer function "HRTF" and/or head-related impulse response "HRIR" to create the illusion that sound is originating from a particular location in 3D acoustic space. The HRTF describes how a given sound wave input is filtered by the diffraction and reflection properties of the head and pinna before the sound reaches the eardrum and inner ear. In other words, an HRTF may be defined based on the difference between a sound in free air and the sound as it arrives at the eardrum.

[0018] FIG. **1** shows a schematic view of a computing system **10** in accordance with an embodiment of the present disclosure. The computing system **10** includes a plurality of electronic gaming machines represented by first electronic gaming machine **14**, second electronic gaming machine **18** and third electronic gaming machine **22**. The plurality of electronic gaming machines may be in communication with a server computing machine **26** via a network **30**, such as the Internet. In some embodiments, two or more of the electronic gaming machines may execute a multi-player game that enables the users of the gaming machines to participate in the game via the network **30**.

[0019] It will be appreciated that virtually any number of different electronic gaming machines may be in communication via the network **30** without departing from the scope of this disclosure. As described in more detail below, one or more of the electronic gaming machines and server **26** may utilize an audio adjustment program **32** in accordance with the present disclosure. In other embodiments, a single electronic gaming machine may execute a game and utilize the audio adjustment program **32** in accordance with the present disclosure.

[0020] With continued reference to FIG. **1**, the first electronic gaming machine **14** may include the audio adjustment program **32** stored in mass storage **34**. In other examples, the audio adjustment program **32** may be streamed to the first electronic gaming machine **14** from server **26** via network **30**. The audio adjustment program **32** may be loaded into memory **36** and executed by a processor **38** of the first electronic gaming machine **14** to perform one or more of the methods and processes described in more detail below. The first electronic gaming machine **14** may further include one or more electronic games, such as first game **40** and second game **42**, that are stored in mass storage **34**. The one or more games may be loaded into memory **36** and executed by the processor **38** to create single-player or multi-player gameplay experiences.

[0021] First game **40** may utilize audio content **44** that includes one or more variable audio parameters **48**. Examples of such variable audio parameters **48** are discussed in more detail below with respect to FIG. **3** and corresponding example use cases. As described in more detail below, the audio adjustment program **32** may adjust a variable audio parameter **48** to provide an audio handicap **50** or an audio advantage **52** in the context of a game. Also as described below, in some embodiments such audio handicaps **50** and audio advantages **52** may correspond to one or more benefits **56** or one or more deficits **58** that may be afforded to a player in the first game **40**.

[0022] First game **40** may include or embody multiple difficulty levels **60** that provide varying challenges for players having varying user ability levels. As described in more detail below, by adjusting a variable audio parameter **48**, the audio adjustment program **32** may increase or decrease a difficulty level **60** of the first game **40**. In some embodiments one or more difficulty levels **60** may be characterized by discrete levels that may be quantified or otherwise described according to their varying difficulty (e.g., Audio Level 1, Audio Level 2, etc.). In other embodiments one or more difficulty levels **60** may not correspond to a discrete characterization, but rather may correspond to a general increase or decrease of game difficulty that is engaged via adjusting a variable audio parameter **48**.

[0023] It will also be appreciated that the second game **42** may also include audio content, variable audio parameters, benefits, deficits, and/or difficulty levels as described above.

[0024] In some embodiments one or more of the audio adjustment program **32**, first game **40**, and second game **42** may be located on server **26**. In these embodiments, one or more of the first electronic gaming machine **14**, second electronic gaming machine **18**, and third electronic gaming machine **22** may not include one or more of the audio adjustment program **32**, first game **40**, and second game **42**, and instead may be communicatively coupled to the server **26** to receive data and/or functionality from one or more of these programs. Alternatively expressed, server **26** may provide a cloud-based service that enables remote computing machines to access one or more of the audio adjustment program **32**, first game **40**, and second game **42**.

[0025] A display device **64** may be operatively connected to the first electronic gaming machine **14**. In some embodiments, the display device may comprise a separate display, such as a standalone monitor or wall-mounted display, that is operatively connected to the first electronic gaming machine **14** via a wired or wireless connection. In other embodiments, first electronic gaming machine **14** may be integrated into the display **64** to form a single device. Such devices may include, for example, desktop computing devices, mobile computing devices such as hand-held smart phones, e-readers, laptops, notebooks and tablet computers, interactive televisions, gaming systems, wearable computing devices such as head-mounted display (HMD) devices, watches, jewelry, computing-capable clothing, or other suitable type of computing device.

[0026] In some embodiments, the display device **64** may take the form of a virtual or mixed-reality capable device, such as an HMD device, that may create a mixed reality environment. The mixed reality environment may include one or more visual elements in the form of virtual images, such as three-dimensional (3D) holographic objects and two-dimensional (2D) virtual images, that are generated and displayed via the HMD device. With reference to FIG. **2**, an example HMD device **200** is shown being worn by a user **201**.

[0027] The first electronic gaming machine **14** and/or the display device **64** may also include or be communicatively coupled, via wired or wireless connections, to one or more speakers **68**. The one or more speakers **68** may broadcast audio content **44** of the first game **40** and/or other audio content to a user **72** of the first electronic gaming machine **14**. In some embodiments the one or more speakers may be

integrated into the first electronic gaming machine **14** or the display **64**. In other embodiments the one or more speakers **68** may be freestanding components that are located or mounted in a physical environment, such as a room. With reference also to FIG. **2**, in some embodiments the speakers **68** may comprise headphones **202** that may be worn by a user **204**.

[0028] The first electronic gaming machine **14** and/or the display device **64** may also include various sensors **86** and related systems. For example, the electronic gaming machine **14** may include an optical sensor system **74** that utilizes at least one outward facing sensor, such as an optical sensor. The outward facing sensor(s) may detect movements within its field of view, such as gesture-based inputs or other movements performed by a user **72** or by a person or physical object within the sensors' field of view. The outward facing sensor(s) may also capture two-dimensional image information and depth information from a physical environment and physical objects within the environment. For example, the outward facing sensor(s) may include a depth camera, a visible light camera, an infrared light camera, and/or a position tracking camera.

[0029] The first electronic gaming machine **14** and/or the display device **64** may include depth sensing via one or more depth cameras. In one example, each depth camera may include left and right cameras of a stereoscopic vision system. Time-resolved images from one or more of these depth cameras may be registered to each other and/or to images from another optical sensor such as a visible spectrum camera, and may be combined to yield depth-resolved video.

[0030] In other embodiments a structured light depth camera may be configured to project a structured infrared illumination, and to image the illumination reflected from a scene onto which the illumination is projected. A depth map of the scene may be constructed based on spacings between adjacent features in the various regions of an imaged scene. In still other embodiments, a depth camera may take the form of a time-of-flight depth camera configured to project a pulsed infrared illumination onto a scene and detect the illumination reflected from the scene. It will be appreciated that any other suitable depth camera may be used within the scope of the present disclosure.

[0031] The first electronic gaming machine **14** and/or the display device **64** may also include a position sensor system **76** that utilizes one or more motion sensors to enable position tracking and/or orientation sensing. For example, the position sensor system **76** may be utilized to determine a head pose orientation of a user's head. In one example, position sensor system **76** may comprise an inertial measurement unit configured as a six-axis or six-degree of freedom position sensor system. This example position sensor system may, for example, include three accelerometers and three gyroscopes to indicate or measure a change in location of the corresponding first electronic gaming machine **14** and/or the display device **64** within three-dimensional space along three orthogonal axes (e.g., x, y, z), and a change in an orientation of the gaming machine and/or display device about the three orthogonal axes (e.g., roll, pitch, yaw).

[0032] Position sensor system **76** may also support other suitable positioning techniques, such as GPS or other global navigation systems. Further, while specific examples of position sensor systems have been described, it will be appreciated that other suitable position sensor systems may be used. It will also be appreciated that user consent may be obtained prior to accessing or utilizing positioning or other personal information related to a user.

[0033] The first electronic gaming machine **14** and/or the display device **64** may also include a microphone system **78** that includes one or more microphones. In this manner, the first electronic gaming machine **14** and/or the display device **64** may receive audio input from a user **72** and/or other sources. In some embodiments, the first electronic gaming machine **14** may use such audio input to infer speaker locations in a physical environment and/or determine a shape, configuration, object location, etc. of a room.

[0034] It will be appreciated that many other types and configurations of sensors and display devices having various form factors, whether separate from or integrated with first electronic gaming machine **14**, may also be used and are within the scope of the present disclosure. Further, additional details regarding the components and computing aspects of the first electronic gaming machine **14**, second electronic gaming machine **18**, third electronic gaming machine **22** and server **26** are described in more detail below with reference to FIG. **7**.

[0035] With reference now to FIGS. **2** and **3**, descriptions of example use cases and embodiments of the present disclosure will now be provided. Turning to FIG. **2** and as described in more detail below, a first user **206** may be playing a first-person shooter game **208** that comprises an interactive digital environment including a user-controlled element **210** (e.g., first-person humanoid character). The game may be executed by a gaming console **212** with images displayed on a wall-mounted display **216** and audio content **44** of the game broadcast via speakers **220**, **222**, **224** and **226** in a living room **230**.

[0036] User-controlled element **210** may be controlled, for example, via a hand-held game controller (not shown) operated by the first user **206**. It will also be appreciated that in other embodiments the user-controlled element **210** may be controlled based on the movement(s) of a human subject imaged by a tracking system **234** that includes an optical sensor system as described above with reference to FIG. **1**. In other embodiments, user-controlled element **210** may be controlled via the HMD device **200**, or via additional and/or different input devices including, but not limited to, keyboards, mice, microphones for voice recognition, and the like.

[0037] While user-controlled element **210** is illustrated as being human-like, it will be appreciated that the term "user-controlled element" refers to any user-controlled element (e.g., vehicle, fantasy character, game perspective, etc.) provided by gaming console **212**. Furthermore, although the user-controlled element **210** is illustrated as being presented via display device **216** in a "first-person" view, it will be appreciated that the user-controlled element may comprise any suitable visual representation without departing from the scope of the present disclosure.

[0038] In the illustrated example of FIG. **2**, the interactive digital environment of game **208** includes virtual space sound source **238** (e.g., weapon muzzle brake of a user-controlled weapon) and virtual space sound source **242** (e.g., tank muzzle brake). As used herein, the term "virtual space sound source" refers to any element (e.g., scenery, user-controlled characters, non-user-controlled characters, etc.) generated by gaming console **212** with which sound is programmatically associated (e.g., "originates" from). In other words, each virtual space sound source includes one or more associated sounds such that, during interaction with the virtual environ-

ment, one or more of the associated sounds are programmed to be "output" from a particular virtual space sound source.

[0039] In the example of FIG. **2**, virtual space sound sources **238** and **242** are illustrated as each comprising respective visual representations **240** and **244** (e.g., muzzle flashes) presented via display **216**. It will also be appreciated that in some embodiments virtual space sound sources may provide sound even when a corresponding visual is not presented via display device **216**. Examples of such "off-screen" sounds include, but are not limited to, ambient sounds, sounds originating from off-screen characters, actions, game elements, etc.

[0040] The game **208** may provide an immersive experience that includes providing audio output via speakers **220**, **222**, **224** and/or **226** such that sounds associated with virtual space sound sources may appear to originate from world space sound source positions in a variety of locations within the room **230**. As used herein, the term "world space sound source position" refers to a position in world space from which one or more sounds of a given virtual space sound source are perceived by a user to originate. In some embodiments and as described in more detail below, one or more virtual space sound sources may correspond to a world space sound source position that is not within the field of view of a user.

[0041] In one example, first user **206** may have extensive experience and skill playing the first-person shooter game **208**. Accordingly and as schematically illustrated in FIG. **3**, a first user ability level **304** (in this example, a gaming ability) of the first user **206** (represented here as "User A") with respect to the game **208** may be correspondingly high. To provide a more challenging gaming experience to first user **206**, the audio adjustment program **32** may adjust a variable audio parameter of the game **208** to increase the difficulty level **60** of the game. Alternatively expressed, the audio adjustment program **32** may create an audio handicap that increases the game difficulty level.

[0042] For example, within the game **208** another player's on-screen avatar may be approaching the user's on-screen avatar (not shown) associated with the user-controlled element **210** from behind the user's avatar, such that the other player's avatar is not displayed on the display **216**. To indicate the approaching on-screen avatar to the first user **206**, the gaming console **212** may generate a default sound **250** that is located at a default world space sound source position **254** corresponding to the location of the approaching avatar. In this example, the default world space sound source position **254** is approximately 3 feet to the right, below and slightly behind the head of the first user **206**.

[0043] In this embodiment, the variable audio parameter may comprise the default world space sound source position **254**, or location, of the default sound **250**. Accordingly, to provide a more challenging experience, the audio adjustment program **32** may move the location of the default sound **250** to an adjusted world space sound source position **254'**. As the adjusted world space sound source position **254'** is further away from and more directly behind and below the first user **206** as compared to the default world space sound source position **254**, this adjusted location would take more movement of the user's on-screen avatar to see and/or engage with the approaching avatar, thus making it more difficult for the first user **206** to respond to the approaching threat. With reference again to FIG. **3**, such an adjusted audio parameter **308** that corresponds to an increased difficulty level is schematically represented within the sound **312**.

[0044] In another example, first user **206** may have limited experience and skill playing the first-person shooter game **208**. Accordingly and as schematically illustrated in FIG. **3**, a second user ability level **314** of the first user **206** (represented here as "User B") with respect to the game **208** may be correspondingly low. To assist the inexperienced first user **206**, the audio adjustment program **32** may adjust a variable audio parameter of the game **208** to decrease the difficulty level **60** of the game. Alternatively expressed, the audio adjustment program **32** may create an audio advantage that decreases the game difficulty level.

[0045] With respect to the example above, the audio adjustment program **32** may move the location of the default sound **250** to an adjusted world space sound source position **254"**. As the adjusted world space sound source position **254"** is closer to the field of view of the first user **206** as compared to the default world space sound source position **254**, this adjusted position would take less movement of the user's on-screen avatar to see and/or engage with the approaching avatar, thus making it easier for the first user to respond to the approaching threat. With reference again to FIG. **3**, such an adjusted audio parameter **316** is schematically represented within the sound **312**. Alternatively expressed, the audio adjustment program **32** may actively change the fidelity of the spatial and auditory cues that the first user **206** uses to navigate while playing the game **208**.

[0046] In other embodiments, a variable audio parameter **48** may comprise a volume of the default sound **250**. Accordingly, to provide a more challenging experience for a player, the audio adjustment program **32** may decrease the volume of the default sound **250** to a decreased volume. In FIG. **2** such a decreased volume is schematically indicated by the smaller size indicator of default sound **250** at adjusted world space sound source position **254'** as compared to the default size indicator of default sound **250** at world space sound source position **254**. With reference to FIG. **3**, such an adjusted audio parameter **308** is also schematically represented within the sound **312**. It will also be appreciated that in some embodiments, the default sound **250** may be muted to provide a more challenging experience for a player. It will also be appreciated that in some examples the audio adjustment program **32** may utilize a decreased volume default sound **250** to provide a benefit to a less experienced user. For example, where the default sound **250** comprises background battlefield sounds, decreasing such sounds may allow the player to hear another game sound, such as footsteps, further away as compared to a more experienced user who is presented with louder background battlefield sounds.

[0047] Conversely, to decrease the difficulty level **60** of the game and provide a less challenging experience, the audio adjustment program **32** may create an audio advantage by increasing the volume of the default sound **250**. In FIG. **2** such an increased volume is indicated by the larger size indicator of default sound **250** at adjusted world space sound source position **254"** as compared to the default size indicator of default sound **250** at world space sound source position **254**. With reference to FIG. **3**, such an adjusted audio parameter **316** is also schematically represented within the sound **312**.

[0048] In other embodiments, a variable audio parameter **48** may comprise a temporality of the default sound **250**. As used herein, "temporality" refers to a timing, sequence, or other temporal aspect of a sound. In one example and to

provide a more challenging experience for a player, the audio adjustment program **32** may delay the broadcast of the default sound **250** to provide less reaction time for the player. For example, where a default timing for the default sound **250** is 3 seconds before the other player's avatar shoots at the avatar of the first user **206**, the audio adjustment program may delay the broadcast of the default sound to 1 second before the other player's avatar shoots.

[0049] Conversely, to decrease the difficulty level **60** of the game and provide a less challenging experience, the audio adjustment program **32** may create an audio advantage by advancing the broadcast of the default sound **250** to provide more reaction time for the player. For example, where the default timing for the default sound **250** is 3 seconds before the other player's avatar shoots at the avatar of the first user **206**, the audio adjustment program may advance the broadcast of the default sound to 5 seconds before the other player's avatar shoots.

[0050] In other embodiments, a variable audio parameter **48** may comprise a frequency of the default sound **250**. For example, the first user **206** may have a hearing impairment that limits the user's ability to hear sounds above 4 Kilohertz (kHz). To provide a more challenging experience for the first user **206**, the audio adjustment program **32** may adjust the default sound **250** such that a greater portion of the sound is above 4 kHz, and less is below 4 kHz, as compared to the unadjusted default sound. In this manner the first user **206** will hear less of the default sound **250**, thereby increasing the chance that the first user may not react appropriately.

[0051] Conversely, to decrease the difficulty level **60** of the game and provide a less challenging experience, the audio adjustment program **32** may create an audio advantage by adjusting the default sound **250** such that a greater portion of the sound is below 4 kHz as compared to the unadjusted default sound. In this manner the first user **206** will hear more of the default sound **250**, thereby increasing the chance that the first user will react appropriately.

[0052] In other embodiments, a variable audio parameter **48** may comprise a type of the default sound **250**. As used herein, "type" refers to an action, occurrence, or event to which a sound corresponds. In one example, the default sound **250** may be a twig snapping that indicates the location of the other players' avatar while sneaking up behind the avatar of the first user **206**. To provide a more challenging experience for the first user **206**, the audio adjustment program **32** may adjust the type of the default sound **250** from a twig snapping to tall grass being brushed, which is a more subtle sound that is more difficult to discern and less likely to trigger alarm. Conversely, to decrease the difficulty level **60** of the game and provide a less challenging experience, the audio adjustment program **32** may create an audio advantage by adjusting the type of the default sound **250** from a twig snapping to a flock of quail being flushed and flying away, which sound comprises a cacophony of quails calling with wings flapping against the wind. Such a sound of quail being flushed is a more distinct and jarring sound that is easier to discern and more likely to trigger alarm.

[0053] In the above embodiments, the user ability level relates to the user's level of skill with respect to a game ("gaming ability"). In other embodiments, the user ability level may relate to a hearing ability of a user. For example, a user may have a hearing impairment as compared to an average human hearing ability. In this example, the audio adjustment program **32** may adjust a variable audio parameter **48**, including but not limited to one or more of the example variable audio parameters discussed above, based on the user's hearing impairment to either increase or decrease the difficulty level **60** of the game. In another example, a user may have an above-average hearing ability as compared to an average human hearing ability. In this example, the audio adjustment program **32** may adjust a variable audio parameter **48** based on the user's above-average hearing to either increase or decrease the difficulty level of the game.

[0054] With reference again to FIG. **1**, in some embodiments one or more user hearing profiles **92** may be stored in audio adjustment program **32** (or in other portions of mass storage of an electronic gaming machine, or on server **26**). A user hearing profile **92** may include data related to a user's hearing ability. Accordingly, in these embodiments the audio adjustment program **32** may utilize data from a user hearing profile **92** to adjust one or more variable audio parameters **48** of a game to one or more adjusted parameters that increase or decrease the difficulty level of the game.

[0055] In one example, the first electronic gaming machine **14** may generate a user hearing profile **92** via input from a user **72**. As described in more detail below, the input may comprise data of the user's performance related to one or more games and/or user ability tests administered by the gaming machine. The input may also comprise user ability information received from the user, such as a self-reported hearing ability. For example, a user may provide voice input to the first electronic gaming machine **14** in which the user states, "I have a hearing deficit in my left ear; please modify the sound in this game to compensate for this deficit."

[0056] In some embodiments, the server **26** may receive one or more hearing profiles **92** from one or more electronic gaming machines or other sources. The server **26** may then provide a hearing profile **92** to one or more other electronic gaming machines to enable the machines to adjust a variable audio parameter of a game to an adjusted audio parameter. In one example, the server **26** may provide a hearing profile **92** associated with a user **72** to the first electronic gaming machine **14** when the user logs into the user's account stored on server **26** via the first machine. The first electronic gaming machine **14** may utilize the hearing profile **92** to adjust a variable audio parameter of the first game **40** or the second game **42** to an adjusted audio parameter when the user **72** initiates a session of either game.

[0057] Subsequently, the user **72** may log into the user's account stored on server **26** via the second electronic gaming machine **18**. The server **26** may then provide the hearing profile **92** associated with user **72** to the second electronic gaming machine **18**. In this manner, the second electronic gaming machine **18** may utilize the hearing profile **92** to adjust a variable audio parameter of the first game **40** or the second game **42** to an adjusted audio parameter when the user **72** initiates a session of either game on the second machine.

[0058] In some embodiments, the first electronic gaming machine **14** may operate on a first platform such as, for example, a first operating system, a first gaming system platform, etc., while the second electronic gaming machine **18** operates on a second platform that is different from the first platform. Advantageously, in this manner the server **26** may facilitate the adjustment of a variable audio parameter **48** across multiple electronic gaming machines operating on different platforms by distributing the hearing profile **92** of a user to each electronic gaming machine used by the user. In other embodiments, the server **26** may facilitate the adjust-

ment of a variable audio parameter **48** across multiple electronic gaming machines operating on different platforms by providing an adjusted audio parameter utilized on the first electronic gaming machine **14** by the user **72** to each other electronic gaming machine used by the user.

[0059] In other embodiments, the user ability level may relate to a user's reaction time to visual and/or aural stimuli. For example, a user may have slower reaction times as compared to an average human's reaction times. In this example, the audio adjustment program **32** may adjust a variable audio parameter **48** to decrease the difficulty level **60** of the game. In another example, a user may have faster reaction times as compared to an average human's reaction times. In this example, the audio adjustment program **32** may adjust a variable audio parameter **48** to increase the difficulty level **60** of the game.

[0060] In some embodiments, data of a user's performance related to the first game **40** and/or second game **42** may be gathered to determine a user ability level of the user. For example, the audio adjustment program **32** may gather data related to a user's levels of achievement playing the first game **40**, and may utilize such data to determine and/or adjust the user ability level of the user. In some embodiments, sensor data from one or more sensors **86** associated with the first electronic gaming machine **14** may be utilized to determine the user ability level of the user.

[0061] In some embodiments, the user **72** may provide an explicit indication of the user's ability level to the audio adjustment program via input to the first electronic gamine machine **14**. For example, the user **72** may say, "I've reached level 7 of 1st Game", "This is my first time playing 1st Game", or provide some other form of input indicating the user's ability level.

[0062] In some embodiments, the audio adjustment program **32** may provide to a user one or more benefits **56** related to a game in exchange for the user accepting an adjusted audio parameter in the form of an audio handicap. For example, in playing the first game **40**, the user **72** may agree to accept one or more adjusted types of sound that increase the difficulty level of the first game from 3 to 5. In one example, a type of sound with a difficulty rating of 3 may be the sound of a twig snapping, while a corresponding type of sound with a difficulty rating of 5 may be the sound of grass brushing. Based on the user **72** accepting such an audio handicap, the audio adjustment program **32** may modify the rewards system of the first game **40** to award the user more points for particular game achievements as compared to the user playing the first game with the type of sound corresponding to a difficulty rating of 3.

[0063] In other embodiments, the audio adjustment program **32** may provide to a user one or more deficits **58** related to a game in exchange for the user accepting an adjusted audio parameter in the form of an audio advantage. For example, in playing the first game **40**, the user **72** may request and accept one or more adjusted locations of sounds that decrease the difficulty level of the first game from 3 to 1. In one example, a location with a difficulty rating of 1 may involve minimal movement of the user **72** to see an approaching threat via display **216**, while a corresponding location of the sound with a difficulty rating of 3 may necessitate additional movement of the user to see the threat. Based on the user **72** accepting such an audio advantage, the audio adjustment program **32** may modify the rewards system of the first game **40** to award the user fewer points for particular game achievements as compared to the user playing the first game with the location of sound corresponding to a difficulty rating of 3.

[0064] In some embodiments, audio handicaps **50** and/or audio advantages **52** may be selectively applied to one or more players of a multi-player game based on different user ability levels of the players. For example, 3 expert-level players may be playing the second game **42** when a new, novice-level player joins the game. Because the novice-level player has a lower user ability level than the 3 expert-level players, an audio handicap **50** may be applied to each of the 3 expert-level players. In addition or alternatively, an audio advantage **52** may be applied to the novice-level player.

[0065] In some embodiments, the audio adjustment program **32** may indicate to the user **72** that an adjusted audio parameter is being utilized to provide audio content of a game via the first electronic gaming machine **14**. With reference to FIG. **2**, in one example an adjusted audio indicator **260** may be displayed on display **216** to indicate that an adjusted audio parameter is being utilized. It will be appreciated that other forms and/or methods may be used to indicate that an adjusted audio parameter is being utilized. Such forms and/or methods include, but are not limited to, audio indicators and haptic feedback indicators via hand-held or wearable controllers or other devices.

[0066] FIGS. **4**A and **4**B show a method **400** of adjusting a variable audio parameter of a game having a difficulty level according to an embodiment of the present disclosure. For example, the method **400** may be performed by the audio adjustment program **32** operating on the first electronic gaming machine **14** shown in FIG. **1**. It will be appreciated that method **400** may also be performed in other contexts using other suitable hardware and software components.

[0067] At **404**, the method **400** may include, based on a user ability level, adjusting the variable audio parameter of the game to an adjusted audio parameter that either increases the difficulty level of the game or decreases the difficulty level of the game. In some embodiments, at **408** the variable audio parameter may comprise a location of a sound. In some embodiments, at **412** the variable audio parameter may comprise a temporality of a sound. In some embodiments, at **416** the variable audio parameter may comprise a volume of a sound relative to an overall volume. In some embodiments, at **420** the variable audio parameter may comprise a frequency of a sound. In some embodiments, at **424** the variable audio parameter may comprise a type of a sound.

[0068] In some embodiments, at **428** the method **400** may include determining the user ability level by gathering data of the user's performance related to the game. In some embodiments, at **432** the method **400** may include determining the user ability level by receiving an indication of ability from the user. In some embodiments, at **436** the method **400** may include determining the user ability level by receiving sensor data from one or more sensors of the electronic gaming machine.

[0069] In some embodiments, at **440** the adjusted audio parameter may comprise an audio handicap. In these embodiments, at **444** the method **400** may include receiving from the user an acceptance of the adjusted audio parameter. At **448** and based on the acceptance, the method **400** may include providing to the user one or more benefits related to the game.

[0070] With reference now to FIG. **4**B, in some embodiments at **452** the adjusted audio parameter may comprise an audio advantage. In these embodiments, at **456** the method **400** may include receiving from the user an acceptance of the

adjusted audio parameter. At **460** and based on the acceptance, the method **400** may include providing to the user one or more deficits related to the game.

[0071] At **464** the method **400** may include utilizing the adjusted audio parameter to provide audio content of the game to a user via the electronic gaming machine. In some embodiments, at **468** the method **400** may include indicating to the user that the adjusted audio parameter is being utilized to provide audio content of the game to the user via the electronic gaming machine.

[0072] It will be appreciated that method **400** is provided by way of example and is not meant to be limiting. Therefore, it is to be understood that method **400** may include additional and/or alternative steps than those illustrated in FIGS. **4**A and **4**B. Further, it is to be understood that method **400** may be performed in any suitable order. Further still, it is to be understood that one or more steps may be omitted from method **400** without departing from the scope of this disclosure.

[0073] FIG. **5** shows a method **500** on an electronic gaming machine according to an embodiment of the present disclosure. For example, the method **500** may be performed by the audio adjustment program **32** operating on the first electronic gaming machine **14** shown in FIG. **1**. It will be appreciated that method **500** may also be performed in other contexts using other suitable hardware and software components.

[0074] At **504**, the method **500** may include executing a game having a sound with a variable audio parameter. In some embodiments, at **508** the variable audio parameter may comprise a location of a sound. In some embodiments, at **512** the variable audio parameter may comprise a temporality of a sound. In some embodiments, at **516** the variable audio parameter may comprise a volume of a sound relative to an overall volume. In some embodiments, at **520** the variable audio parameter may comprise a frequency of a sound. In some embodiments, at **524** the variable audio parameter may comprise a type of a sound. At **528** the method **500** may include setting the variable audio parameter of the sound based on a gaming ability of a user playing the game. In some embodiments, at **532** the method **500** may include determining the gaming ability of the user by receiving sensor data from one or more sensors of the electronic gaming machine.

[0075] It will be appreciated that method **500** is provided by way of example and is not meant to be limiting. Therefore, it is to be understood that method **500** may include additional and/or alternative steps than those illustrated in FIG. **5**. Further, it is to be understood that method **500** may be performed in any suitable order. Further still, it is to be understood that one or more steps may be omitted from method **500** without departing from the scope of this disclosure.

[0076] FIG. **6** shows a method **600** on a computing machine of adjusting a variable audio parameter of a game having a difficulty level across a plurality of different electronic gaming machines according to an embodiment of the present disclosure. For example, the method **600** may be performed by the audio adjustment program **32** operating on the server **26** shown in FIG. **1**. It will be appreciated that method **600** may also be performed in other contexts using other suitable hardware and software components.

[0077] At **604**, the method **600** may include receiving a hearing profile of a user. At **608** the method **600** may include providing the hearing profile to a first electronic gaming machine to enable the first electronic gaming machine to adjust the variable audio parameter of the game based on the hearing profile to an adjusted audio parameter that either increases the difficulty level of the game or decreases the difficulty level of the game. At **612** the method **600** may include providing the hearing profile to a second electronic gaming machine to enable the second electronic gaming machine to adjust the variable audio parameter of the game based on the hearing profile to the adjusted audio parameter.

[0078] It will be appreciated that method **600** is provided by way of example and is not meant to be limiting. Therefore, it is to be understood that method **600** may include additional and/or alternative steps than those illustrated in FIG. **6**. Further, it is to be understood that method **600** may be performed in any suitable order. Further still, it is to be understood that one or more steps may be omitted from method **600** without departing from the scope of this disclosure.

[0079] It will also be appreciated that in some embodiments, the methods and processes described herein may be tied to a computing system of one or more computing machines. In particular, such methods and processes may be implemented as a computer-application program or service, an application-programming interface (API), a library, and/or other computer-program product.

[0080] FIG. **7** schematically shows a non-limiting embodiment of a computing system **700** that can enact one or more of the methods and processes described above. For example, computing system **700** may be representative of the first electronic gaming machine **14**, second electronic gaming machine **18** or the server **26** shown in FIG. **1**. Computing system **700** is shown in simplified form. Computing system **700** may take the form of one or more personal computers, server computers, tablet computers, home-entertainment computers, network computing machines, gaming devices, mobile computing machines, mobile communication devices (e.g., smart phone), and/or other computing machines.

[0081] Computing system **700** includes a logic machine **702** and a storage machine **704**. Computing system **700** may optionally include a display subsystem **706**, input subsystem **708**, communication subsystem **710**, sensor subsystem **712** (analogous to the sensors **86** of FIG. **1**), audio subsystem **714** (analogous to speakers **68** of FIG. **1**, speakers **220**, **222**, **224**, and **226** of FIG. **2**, and headphones **202** of FIG. **2**), and/or other components not shown in FIG. **7**.

[0082] Logic machine **702** includes one or more physical devices configured to execute instructions. For example, the logic machine may be configured to execute instructions that are part of one or more applications, services, programs, routines, libraries, objects, components, data structures, or other logical constructs. Such instructions may be implemented to perform a task, implement a data type, transform the state of one or more components, achieve a technical effect, or otherwise arrive at a desired result.

[0083] The logic machine **702** may include one or more processors configured to execute software instructions. Additionally or alternatively, the logic machine **702** may include one or more hardware or firmware logic machines configured to execute hardware or firmware instructions. Processors of the logic machine **702** may be single-core or multi-core, and the instructions executed thereon may be configured for sequential, parallel, and/or distributed processing. Individual components of the logic machine **702** optionally may be distributed among two or more separate devices, which may be remotely located and/or configured for coordinated processing. Aspects of the logic machine **702** may be virtualized and executed by remotely accessible, networked computing machines configured in a cloud-computing configuration.

[0084] Storage machine **704** includes one or more physical devices configured to hold instructions executable by the logic machine **702** to implement the methods and processes described herein. When such methods and processes are implemented, the state of storage machine **704** may be transformed—e.g., to hold different data.

[0085] Storage machine **704** may include removable and/or built-in devices. Storage machine **704** may include optical memory (e.g., CD, DVD, HD-DVD, Blu-Ray Disc, etc.), semiconductor memory (e.g., RAM, EPROM, EEPROM, etc.), and/or magnetic memory (e.g., hard-disk drive, floppy-disk drive, tape drive, MRAM, etc.), among others. Storage machine **704** may include volatile, nonvolatile, dynamic, static, read/write, read-only, random-access, sequential-access, location-addressable, file-addressable, and/or content-addressable devices.

[0086] It will be appreciated that storage machine **704** includes one or more physical devices. However, aspects of the instructions described herein alternatively may be propagated by a communication medium (e.g., an electromagnetic signal, an optical signal, etc.) that is not held by a physical device for a finite duration.

[0087] Aspects of logic machine **702** and storage machine **704** may be integrated together into one or more hardware-logic components. Such hardware-logic components may include field-programmable gate arrays (FPGAs), program- and application-specific integrated circuits (PASIC/ASICs), program- and application-specific standard products (PSSP/ASSPs), system-on-a-chip (SOC), and complex programmable logic devices (CPLDs), for example.

[0088] It will be appreciated that a "service", as used herein, is an application program executable across multiple user sessions. A service may be available to one or more system components, programs, and/or other services. In some implementations, a service may run on one or more server-computing machines.

[0089] When included, display subsystem **706** may be used to present a visual representation of data held by storage machine **704**. This visual representation may take the form of a graphical user interface (GUI). As the herein described methods and processes change the data held by the storage machine, and thus transform the state of the storage machine, the state of display subsystem **706** may likewise be transformed to visually represent changes in the underlying data. Display subsystem **706** may include one or more display devices utilizing virtually any type of technology. Such display devices may be combined with logic machine **702** and/or storage machine **704** in a shared enclosure, or such display devices may be peripheral display devices. Examples of such display devices include, but are not limited to, the display **64** of FIG. **1**, and the HMD device **200** and wall-mounted display **216** of FIG. **2**.

[0090] When included, input subsystem **708** may comprise or interface with one or more user-input devices such as a keyboard, mouse, touch screen, or game controller. In some embodiments, the input subsystem may comprise or interface with selected natural user input (NUI) componentry. Such componentry may be integrated or peripheral, and the transduction and/or processing of input actions may be handled on- or off-board. Example NUI componentry may include a microphone for speech and/or voice recognition; an infrared, color, stereoscopic, and/or depth camera for machine vision and/or gesture recognition; a head tracker, eye tracker, accelerometer, and/or gyroscope for motion detection and/or intent recognition; as well as electric-field sensing componentry for assessing brain activity.

[0091] When included, communication subsystem **710** may be configured to communicatively couple computing system **700** with one or more other computing machines. Communication subsystem **710** may include wired and/or wireless communication devices compatible with one or more different communication protocols. As non-limiting examples, the communication subsystem may be configured for communication via a wireless telephone network, or a wired or wireless local- or wide-area network. In some embodiments, the communication subsystem may allow computing system **700** to send and/or receive messages to and/or from other devices via a network such as the Internet.

[0092] When included, sensor subsystem **712** may include one or more sensors configured to sense different physical phenomenon (e.g., visible light, infrared light, sound, acceleration, orientation, position, etc.) as described above. Sensor subsystem **712** may be configured to provide sensor data to logic machine **702**, for example. Such data may include, but is not limited to, audio information, depth tracking information, image information, gaze tracking information, ambient lighting information, position information, motion information, user location information, and/or any other suitable sensor data that may be used to perform the methods and processes described above.

[0093] It will be understood that the configurations and/or approaches described herein are exemplary in nature, and that these specific embodiments or examples are not to be considered in a limiting sense, because numerous variations are possible. The specific routines or methods described herein may represent one or more of any number of processing strategies. As such, various acts illustrated and/or described may be performed in the sequence illustrated and/or described, in other sequences, in parallel, or omitted. Likewise, the order of the above-described processes may be changed.

[0094] The subject matter of the present disclosure includes all novel and nonobvious combinations and subcombinations of the various processes, systems and configurations, and other features, functions, acts, and/or properties disclosed herein, as well as any and all equivalents thereof.

1. On an electronic gaming machine, a method of adjusting a variable audio parameter of a game having a difficulty level, comprising:

based on a user ability level, adjusting the variable audio parameter of the game to an adjusted audio parameter that either increases the difficulty level of the game or decreases the difficulty level of the game; and

utilizing the adjusted audio parameter to provide audio content of the game to a user via the electronic gaming machine.

2. The method of claim **1**, wherein the variable audio parameter comprises a location of a sound.

3. The method of claim **1**, wherein the variable audio parameter comprises a temporality of a sound.

4. The method of claim **1**, wherein the variable audio parameter comprises a volume of a sound relative to an overall volume.

5. The method of claim **1**, wherein the variable audio parameter comprises a frequency of a sound.

6. The method of claim **1**, wherein the variable audio parameter comprises a type of a sound.

7. The method of claim **1**, wherein the user ability level is determined by gathering data of the user's performance related to the game.

8. The method of claim **1**, wherein the user ability level is determined by receiving an indication of ability from the user.

9. The method of claim **1**, wherein the user ability level is determined by receiving sensor data from one or more sensors of the electronic gaming machine.

10. The method of claim **1**, wherein the adjusted audio parameter comprises an audio handicap, and further comprising receiving from the user an acceptance of the adjusted audio parameter; and based on the acceptance, providing to the user one or more benefits related to the game.

11. The method of claim **1**, wherein the adjusted audio parameter comprises an audio advantage, and further comprising receiving from the user an acceptance of the adjusted audio parameter; and based on the acceptance, providing to the user one or more deficits related to the game.

12. The method of claim **1**, further comprising indicating to the user that the adjusted audio parameter is being utilized to provide audio content of the game to the user via the electronic gaming machine.

13. A method on an electronic gaming machine, comprising:

executing a game having a sound with a variable audio parameter; and

setting the variable audio parameter of the sound based on a gaming ability of a user playing the game.

14. The method of claim **13**, wherein the variable audio parameter comprises a location of a sound.

15. The method of claim **13**, wherein the variable audio parameter comprises a temporality of a sound.

16. The method of claim **13**, wherein the variable audio parameter comprises a volume of a sound relative to an overall volume.

17. The method of claim **13**, wherein the variable audio parameter comprises a frequency of a sound.

18. The method of claim **13**, wherein the variable audio parameter comprises a type of a sound.

19. The method of claim **13**, wherein the gaming ability of the user is determined by receiving sensor data from one or more sensors of the electronic gaming machine.

20. On a computing machine, a method of adjusting a variable audio parameter of a game having a difficulty level across a plurality of different electronic gaming machines, comprising:

receiving a hearing profile of a user;

providing the hearing profile to a first electronic gaming machine of the plurality of electronic gaming machines to enable the first electronic gaming machine to adjust the variable audio parameter of the game based on the hearing profile to an adjusted audio parameter that either increases the difficulty level of the game or decreases the difficulty level of the game; and

providing the hearing profile to a second electronic gaming machine of the plurality of electronic gaming machines to enable the second electronic gaming machine to adjust the variable audio parameter of the game based on the hearing profile to the adjusted audio parameter.

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