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(54) **APPARATUS, SYSTEM AND METHOD OF
MULTISENSORY STIMULATION**

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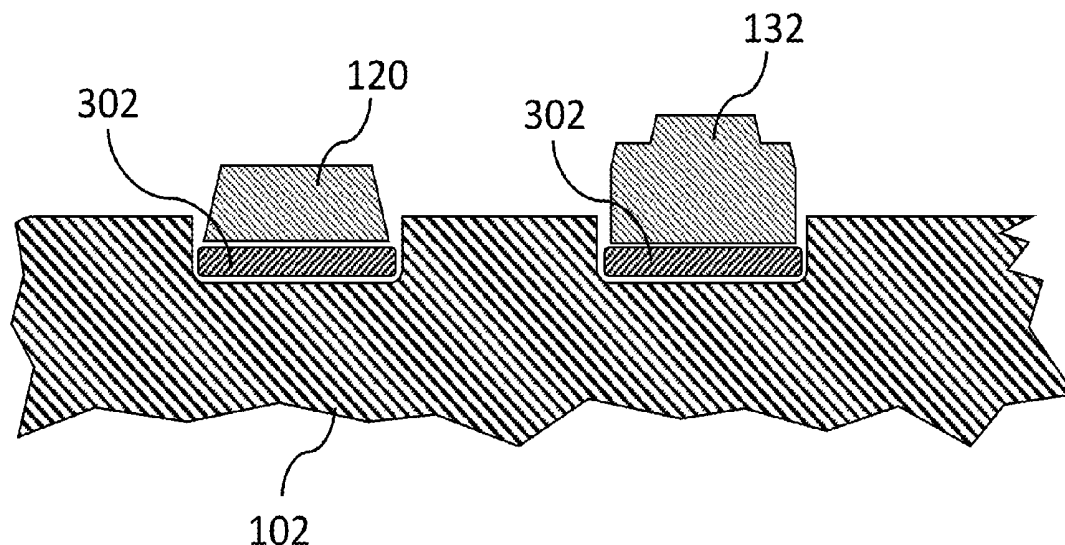
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ABSTRACT

In an exemplary embodiment, a body-supporting structure for multisensory stimulation may be provided. The body-supporting structure for multisensory stimulation may include a number of biometric measurement devices for detecting a user's state and a number of speakers or transducers connected to resonators on the body-supporting structure and arranged to transfer a stimulus in accordance with the state detected. A computing device may be connected to the biometric measurement devices and to a virtual reality display. A number of input devices may also be connected to the computing device and to a number of amplifiers configured to transfer a signal to the number of speakers and transducers.



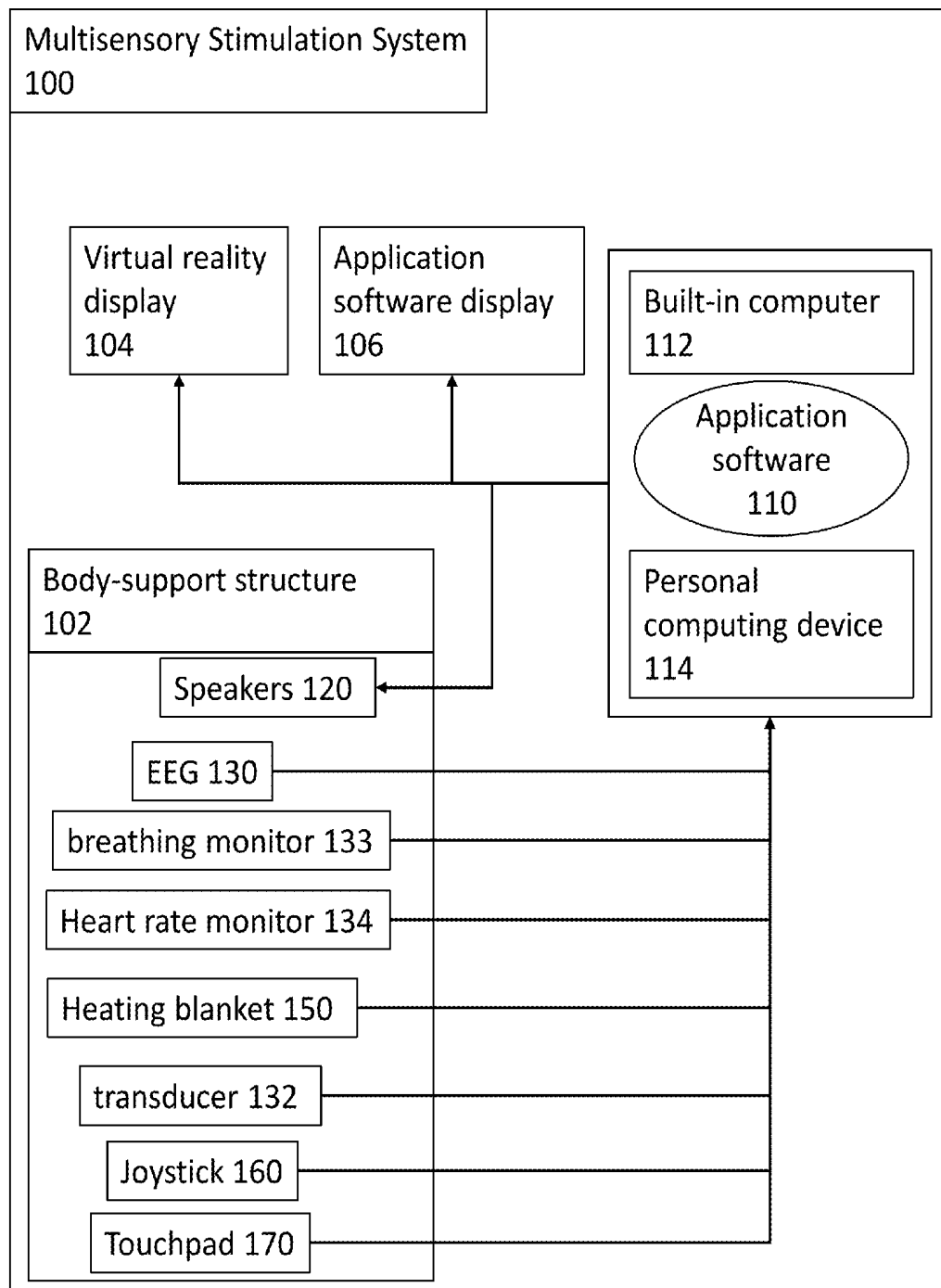


Fig. 1

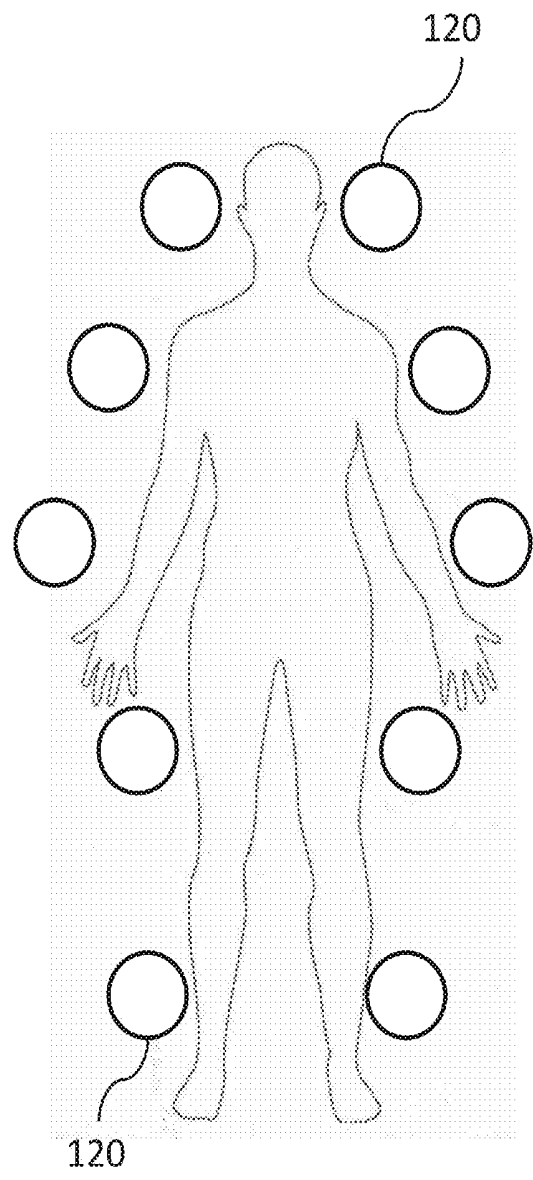


Fig. 2A

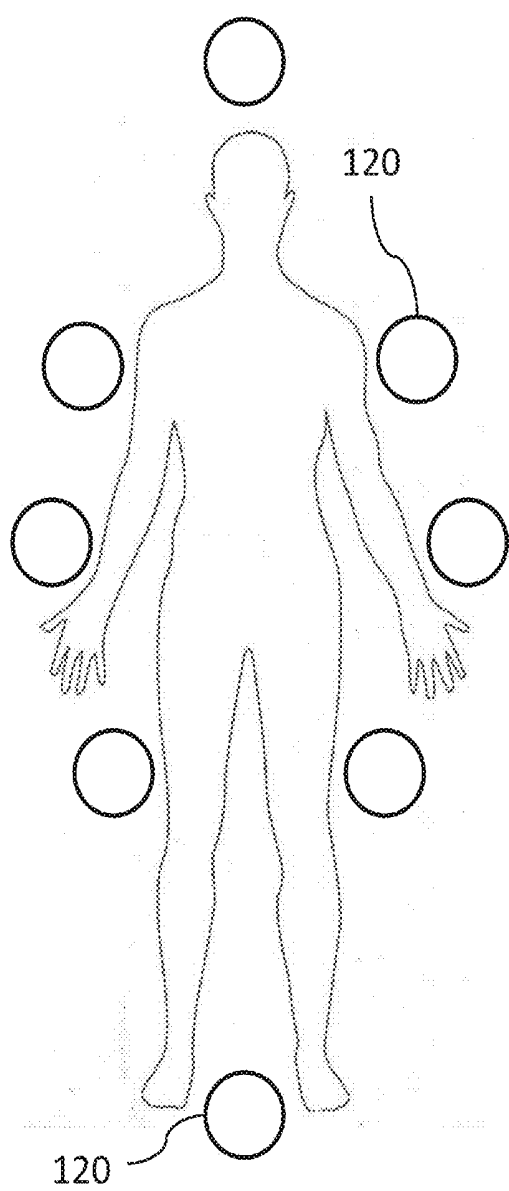


Fig. 2B

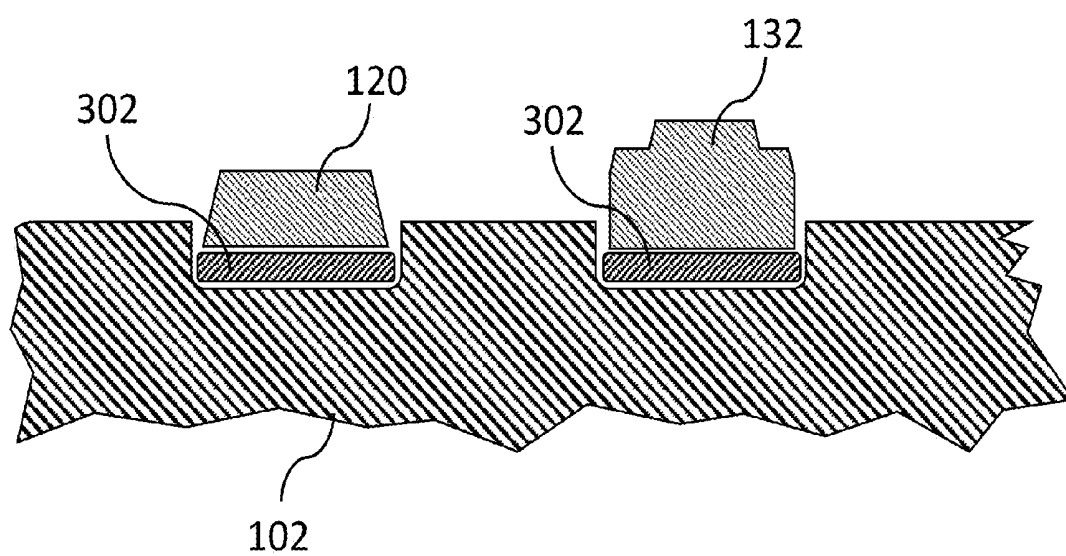


Fig. 3

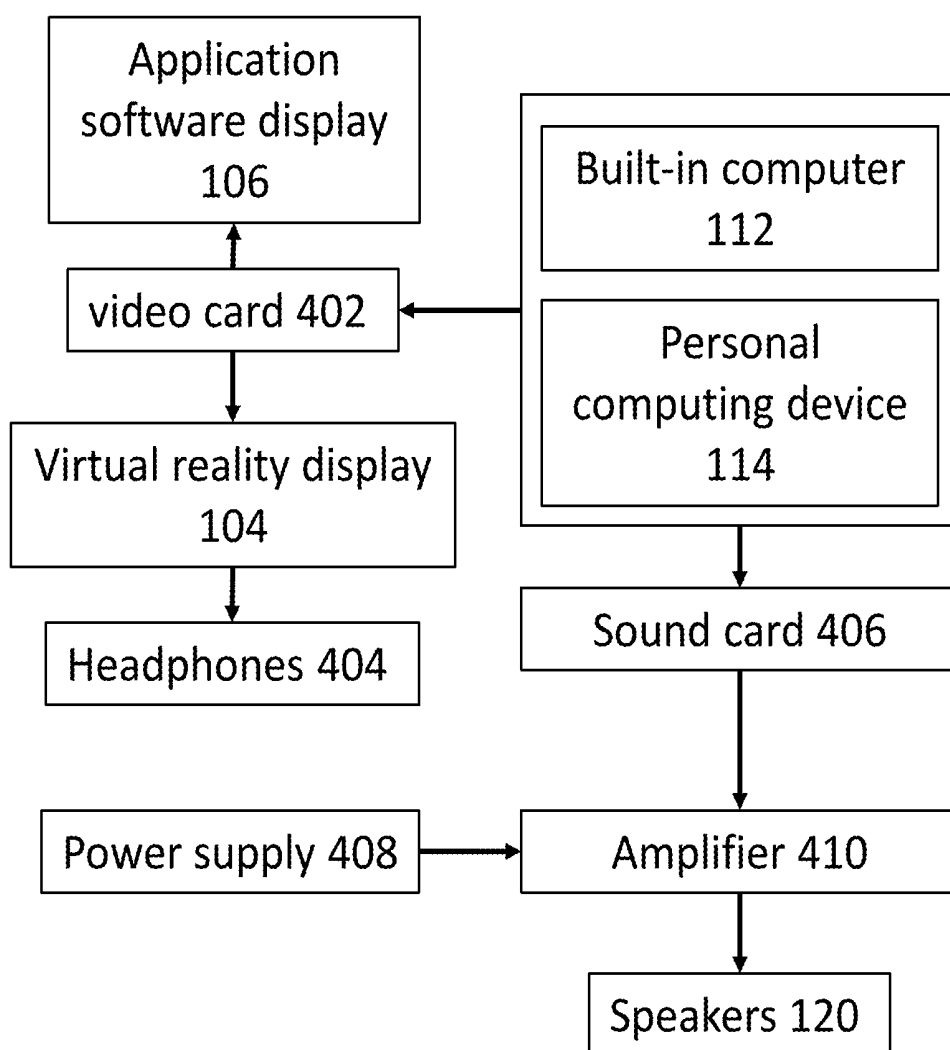


Fig. 4

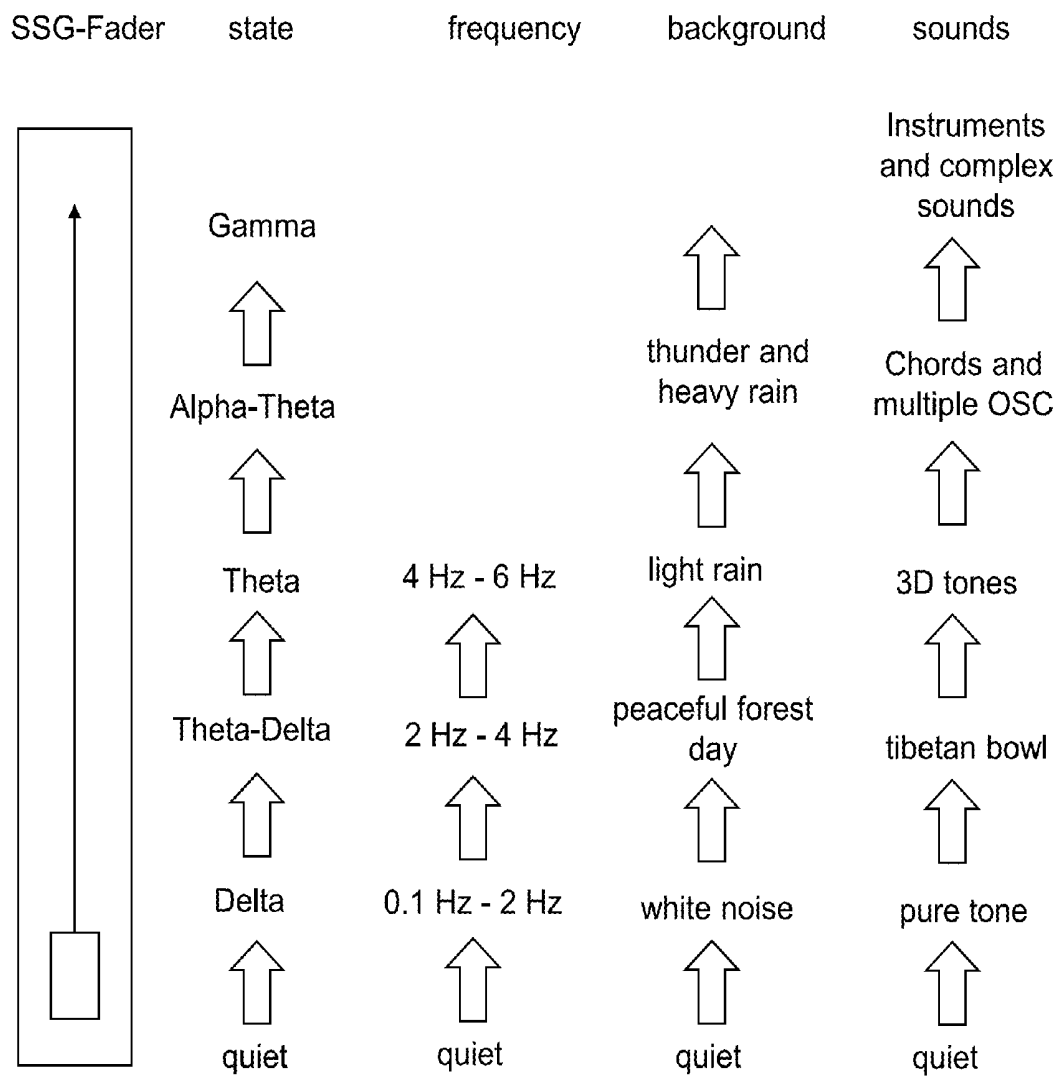


Fig. 5

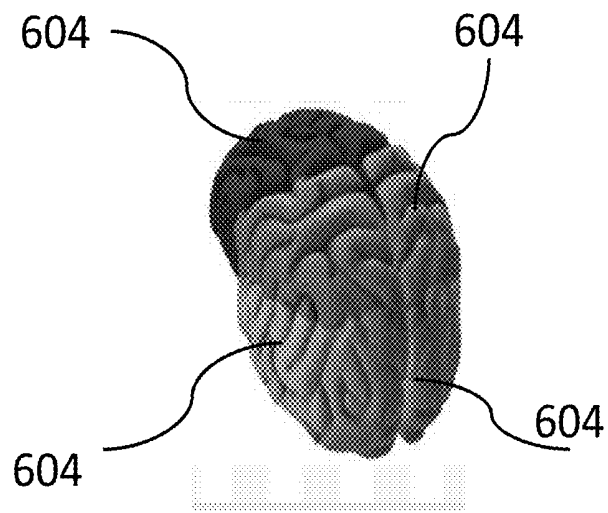


Fig. 6

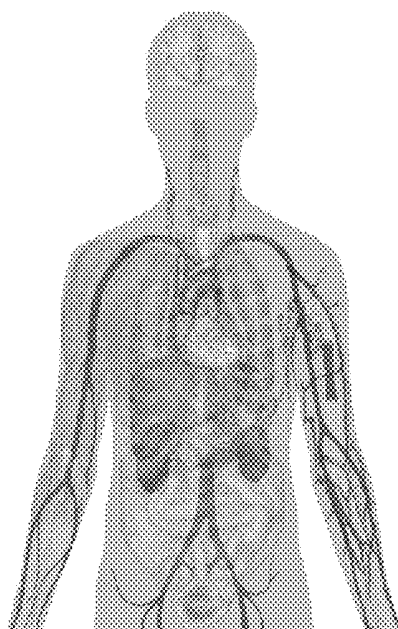


Fig. 7A

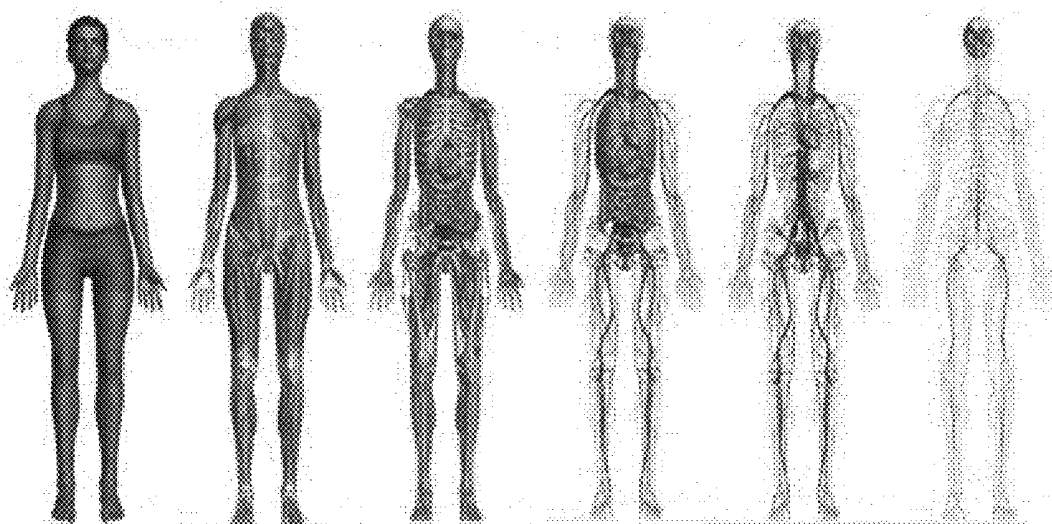


Fig. 7B

APPARATUS, SYSTEM AND METHOD OF MULTISENSORY STIMULATION

BACKGROUND

[0001] Vibroacoustic therapy may combine sounds and music selected to resonate in specific areas of the body. Layers of binaural beats may be added to music and low frequency pulses to promote deep relaxation. The sound vibrations may be administered through specially designed speakers or transducers built into a piece of furniture or a body-supporting structure such as a recliner, beanbag, mattress, pad, or a table. There may be several benefits to health and well-being from the experience of feeling the sounds and vibrations provided by the vibroacoustic treatment. Vibroacoustic therapy alone, or associated with binaural beats may be helpful for a variety of severe conditions such as sports injury, muscular strain or post-surgery, as well as chronic conditions such as asthma, arthritis, menstrual pain and stress.

SUMMARY

[0002] In an exemplary embodiment, a body-supporting structure for multisensory stimulation may be provided. The body-supporting structure for multisensory stimulation may include a number of biometric measurement devices for detecting a user's state and a number of speakers or transducer connected to resonators on the body-supporting structure and arranged to transfer a stimulus in accordance with the state detected. A computing device may be connected to the biometric measurement device and to a virtual reality display. A number of input devices may also be connected to the computing device and to a number of amplifiers configured to transfer a signal to the number of speakers and transducers

[0003] In a second exemplary embodiment, a method of providing multisensory stimulation may be provided. The method of providing multisensory stimulation may include providing a body-supporting structure for multisensory stimulation, placing a user in physical contact with the body-supporting structure and operating the at least one input device and the amplifier so as to expose the user to vibration and sounds from at least one of the at least one speakers and at least one the transducer. The body-supporting structure for multisensory stimulation may include a number of biometric measurement devices for detecting a user's state and a number of speakers or transducer connected to resonators on the body-supporting structure and arranged to transfer a stimulus in accordance with the state detected. A computing device may be connected to the biometric measurement device and to a virtual reality display. A number of input devices may also be connected to the computing device and to a number of amplifiers configured to transfer a signal to the number of speakers and transducers

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Advantages of embodiments of the present invention will be apparent from the following detailed description of the exemplary embodiments. The following detailed description should be considered in conjunction with the accompanying figures in which:

[0005] FIG. 1 is a diagram showing an exemplary embodiment of a multisensory stimulation system;

[0006] FIG. 2A is a diagram showing an exemplary embodiment of a 10 speakers configuration;

[0007] FIG. 2B is a diagram showing an exemplary embodiment of an 8 speakers configuration;

[0008] FIG. 3 is a diagram showing an exemplary embodiment of speaker and transducer connected to a body supporting element;

[0009] FIG. 4 is a diagram showing an exemplary embodiment of electronic elements connections;

[0010] FIG. 5 is a diagram showing an exemplary embodiment of sounds and frequencies produced by the fader and their associated states;

[0011] FIG. 6 is a diagram showing an exemplary embodiment of a brain representation; and

[0012] FIG. 7A is a diagram showing an exemplary embodiment of a body and organ representation.

[0013] FIG. 7B is a diagram showing an exemplary embodiment of a body and organ representation.

DETAILED DESCRIPTION

[0014] Aspects of the present invention are disclosed in the following description and related figures directed to specific embodiments of the invention. Those skilled in the art will recognize that alternate embodiments may be devised without departing from the spirit or the scope of the claims. Additionally, well-known elements of exemplary embodiments of the invention will not be described in detail or will be omitted so as not to obscure the relevant details of the invention.

[0015] As used herein, the word "exemplary" means "serving as an example, instance or illustration." The embodiments described herein are not limiting, but rather are exemplary only. It should be understood that the described embodiments are not necessarily to be construed as preferred or advantageous over other embodiments. Moreover, the terms "embodiments of the invention", "embodiments" or "invention" do not require that all embodiments of the invention include the discussed feature, advantage or mode of operation.

[0016] Further, many of the embodiments described herein may be described in terms of sequences of actions to be performed by, for example, elements of a computing device. It should be recognized by those skilled in the art that the various sequence of actions described herein can be performed by specific circuits (e.g., application specific integrated circuits (ASICs)) and/or by program instructions executed by at least one processor. Additionally, the sequence of actions described herein can be embodied entirely within any form of computer-readable storage medium such that execution of the sequence of actions enables the processor to perform the functionality described herein. Thus, the various aspects of the present invention may be embodied in a number of different forms, all of which have been contemplated to be within the scope of the claimed subject matter. In addition, for each of the embodiments described herein, the corresponding form of any such embodiments may be described herein as, for example, "a computer configured to" perform the described action.

[0017] In an exemplary embodiment illustrated in FIG. 1, the multisensory stimulation system 100 may include a computing device such as a built-in computer 112 or a personal computing device 114 that may run an application software 110. The personal computing device 114 may include, but not be limited to, a laptop, a smartphone, a

desktop, and a tablet that may be connected to the multisensory stimulation system **100**. An application software **110** may be used to control the multisensory stimulation system **100** functionalities. The personal computing device **114** may be connected to the multisensory stimulation system **100** using a mobile dock, a USB cable, or by remote connectivity such as, BLUETOOTH or wireless internet, as would be understood by a person having ordinary skill in the art. Once the user's phone may be connected it may not function as a phone, it may not be able to receive calls or messages so the user is not interrupted during the session. The user may have to give permission to disable communication features before the application software **110** may be launched. Further, the multisensory stimulation system **100** and the application software **110** may be configured to receive updates using an internet connection. The application software **110** may be available separately and may be downloadable from a website or an application software store. The application software **110** may be used on its own and may allow the user to have a session while away from the multisensory stimulation system.

[0018] Still referring to FIG. 1, the multisensory stimulation system **100** may include a body-supporting structure **102** providing a relaxing posture such as, but not limited to, a chair, a recliner, or a bed. The multisensory stimulation system **100** may be connected to a number of other devices such as, but not limited to electroencephalography systems (EEG) **130**, a breathing monitor **133**, a heart rate monitor **134**, a heating blanket **150**, transducers **132**, a touchpad **170**, joystick **160** or the like. Further, a virtual reality display **104** and an application software display **106** may be connected to the built-in computer **112** or to the personal computing device **114**.

[0019] In an exemplary embodiment illustrated in FIGS. 2A and 2B, the multisensory stimulation system **100** may include a number of speakers **120**. The speakers **120** may be disposed evenly along the body in a 10-speakers configuration (FIG. 2A) or in an 8-speakers configuration (FIG. 2B) or any number of pairs. The speakers **120** may be associated in pairs for stereo signal rendering. It may be appreciated that any desired configuration and number of speakers may be connected to the multisensory stimulation system **100**, as may be understood by a person having ordinary skill in the art.

[0020] In an exemplary embodiment illustrated in FIG. 3, each speaker **120** or transducer **132** may be rigidly connected to a resonator **302**. It may be appreciated that the resonator surface may be of any desired materials including, but not limited to, wood, metal, and polymer, as may be understood by a person having ordinary skill in the art. Additionally, each speaker **120** or transducer **132** may be isolated from each other so as to contain the sound within a desired location and prevent vibrations from being spread around the body-supporting structure **102**.

[0021] The multisensory stimulation system **100** may create multiple audio channels and feed each channel to a specific speaker or to headphones. The multisensory stimulation system **100** may also include dedicated hardware, cables, and devices that may divide signals and create multiple outputs for the headphones and speakers. Different sounds may be sent to individual speakers **120** so as to target specific locations in the body. For example, a sound may be sent to a number of speakers **120** located near the chest and may be panned slightly to the left to focus most of the sound

energy to the heart. In a further example, the multisensory stimulation system **100** may circulate the vibrational frequencies by connecting one oscillator to the left speaker and a second oscillator to the right speaker.

[0022] In an exemplary embodiment illustrated in FIG. 4, the built-in computer **112** or the personal computing device **114** may be connected to a graphic or video card **402** that may send data to the application software display **106** and to the virtual reality display **104**. Headphones may optionally be connected to the virtual reality display **104** or directly to the sounds device and synchronize to the visuals from the virtual reality display. The built-in computer **112** or the personal computing device **114** may further be connected to a sound card **406** that may send signals to an amplifier **410** connected to a power supply **408**. The amplifier board **410** may then feed the amplified sound to a number of speakers **120**.

[0023] The multisensory stimulation system **100** may create complex routing to the speakers **120** and may bring vibrational circulation around the body so as to release stuck energy and emotion. The vibrational circulation may help the blood circulating and massage the nervous system. Because of its vibrational nature, the sound may penetrate deeply into the body and may release deep tensions imperious to regular massages.

[0024] Binaural recording (or other 360 surround sound recording method) is a method of recording sound that may use two microphones, arranged with the intent to create a 3D stereo sound, or surround sound effect. It may be appreciated that more than two microphones may be utilized such as b-format method using a four-channel microphone, 32 microphones systems, or any desired technology designed to obtain better and accurate 360-surround recording. The surround sound may give to the user the impression of being immersed in the sound. For example, the user may have the impression of actually being in a room with performers playing music. This effect may be created using a technique known as "dummy head recording", wherein a mannequin head is outfitted with a microphone in each ear. Binaural recording may be primarily intended for replay using headphones.

[0025] In an exemplary embodiment, the application software **110** may create binaural sounds even if the sounds were not recorded with dummy head or 3D microphones. The application software **110** may use binaural technology so as to reproduce psychoacoustic sound or virtually created 360 spaces and environment. The application software **110** may use specialized tools such as, but not limited to, digital signal processing (DSP) technology for creating realistic 3D soundscapes using regular stereo sound. The application software may combine HRTF-based audio panning with acoustic environment modeling, and may include, but not be limited to wall reflections, reverberation, distance modeling, and the Doppler pitch effect. The HRTF may be a linear function is based on the sound source's position and may take into account many of the cues humans use to localize sounds. The HRTF may be used to develop pairs of finite impulse response (FIR) filters for specific sound positions; each sound position may require two filters, one for the left ear, and one for the right. Thus, to place a sound at a certain position in virtual space, the set of FIR filters that correspond to the position may be applied to the incoming sound, yielding spatial sound. The computations involved in convolving the sound signal from a particular point in space

may require specialized equipment. The 3D soundscape may be synchronized to the visuals on the virtual reality display 104. The application software 110 may create a virtual 3D space from a stereo signal. However, it may be appreciated that the application software 110 may use any desired technological solution for creating and reproducing a 3D, or 360° sound image from a single sound source, as may be understood by a person having ordinary skill in the art. Further, the application software 110 may virtually direct the sounds to a specific position in space or in the user's brain and body.

[0026] In an exemplary embodiment, unique surround sounds may be recorded with 360° or binaural recording equipment in different places or spaces such as during a walk in nature, playing crystal bowls or the like. Multiple tones may play together to create sound octaves and therapeutic harmonies by the sacred geometry intervals. The multisensory stimulation system 100 may also control low pass filters so as to achieve a smooth fade in and out between sounds, and may be combined with controls of the volume fade in and out.

[0027] In another exemplary embodiment, the multisensory stimulation system 100 may include a virtual reality display 104. The display may include 3D capabilities, such as a 3D screen and 3D headgear, augmented reality, and holograms as may be understood by a person having ordinary skill in the art. The virtual reality display 104 may show virtual places, spaces, shapes, colors, or the like. Images shown in the virtual reality display 104 may correspond to frequencies generated by the multisensory stimulation system 100.

[0028] In a further exemplary embodiment, the image shown on the display may be related to, and synchronized with, the session. For example, the sound of a walk in the forest may be associated with forest visuals shown on the display or a shape may flicker on and off by the same frequency rate as the binaural beats that may be playing. A physical or digital tapping device or the touchpad 170 may allow the user to tap a desired tempo that may be used to adjust session parameters. Sessions may be rated by the user and the multisensory stimulation system 100 may configure new sessions according to ratings and may send feedback to a third party for future adjustments and monitoring.

[0029] The multisensory stimulation system 100 may provide therapeutic treatment during dedicated periods of time defined as sessions. Each session may be paused or canceled. If a user cancels the session, the sound may fade out until quiet. During the session, the volume of the sound may be controlled by a digital or analog volume knob, touchpad 170, joystick 160, or the like. The session may fade out and the multisensory stimulation system 100 may shut itself off when the user is not on the body-supporting structure 102, as may be detected by motion or weight sensors that may be connected to the multisensory stimulation system 100. In an exemplary embodiment, a human voice or a video shown on the virtual reality display 104 (for example, 3D headgear) may guide and direct the user before during and after the session.

[0030] In an exemplary embodiment, illustrated in FIG. 5, the application software 110 may provide a physical or digital fader allowing the user to modify the session in real time. The fader may provide the user with the ability to modify his current state or to change the session properties in a unique and simple way. Further, the session properties

may be modified while laying, sitting, and even with closed eyes, as may be understood by a person having ordinary skill in the art. The fader settings may be changed, for example, by simple interaction with a touchpad 170. The fader and may be designed and configured to minimize movements and mental efforts required to change the settings. The fader may be referred to as a self state generator (SSG) used to modify the user's state by increasing or decreasing the fader values. It may be appreciated that what is referred to as the "user's state" or "state" may include, but not be limited to, mental state, state of mind, state of consciousness, mood, focus, and disposition, as may be understood by a person having ordinary skill in the art. Modification of the fader's parameters may modify frequencies and tone pitches so as to achieve complex sounds, as may be understood by a person of ordinary skill in the art. The multisensory stimulation system 100 may allow the user to tune instinctively the sound properties to attain a desired state. Higher frequencies may be responsible for creativity, focus, higher memory skills, and awareness. Whereas the lower frequencies may be responsible for the sleep state, relaxing state, healing state, meditative state, underworld state, internal state, and spiritual state.

[0031] In an exemplary embodiment, a circulation effect may be achieved when using frequencies of approximately 30 Hz on a left speaker and approximately 31 Hz on a right speaker. This circulation effect may be caused by the binaural effect, as the right frequencies may be increased, a feeling of faster circulation may be achieved. The multisensory stimulation system 100 may have a number of oscillators that may produce specific frequencies and may play concurrently with other oscillators. When the frequency difference between the oscillators is between approximately 0.1 Hz to approximately 30 Hz, binaural beats may be created. The lowest frequency produced by the fader may be approximately 0.1 Hz. The frequency of approximately 0.1 Hz may be created by having a first oscillator set to approximately 100 Hz and a second oscillator set to approximately 100.1 Hz. Similarly, a cycle of 8 Hz (alpha range) may be obtained if the second oscillator increases the frequency from approximately 100.1 Hz to approximately 108 Hz. The fader may be virtually divided into an infinite number of steps that may have different session parameters. The vibrations generated by the multisensory stimulation system 100 may be of low frequencies to high frequencies of approximately 20,000 Hz. Further, each frequency may be modified within each fader step and modifications of the fader steps may modify frequency cycles and background sounds. Background sounds of a storm or heavy ocean may be associated with a frequency in the beta or gamma range of approximately 30 Hz that may correspond to a state of awakening.

[0032] In a further exemplary embodiment, the multisensory stimulation system 100 may use unique and specific tones such as, but not limited to, binaural beats, pure sin waves, random sounds, atmosphere sounds, weather sounds, 3D sounds, and vibrations that may be mixed together and may be directed to specific internal and external body parts. The sound sources may not be limited to the technology currently available and may be created using other external sources that produces sound. The sound frequencies may be delivered to the user from any direction, and may not be limited to front, back, above, and below the user, as would be understood by a person having ordinary skill in the art.

[0033] A number of other functions and benefits may be associated with the body-supporting structure **102**. In an exemplary embodiment, the multisensory stimulation system **100** may include a number of ultrasonic transducers and a number of transducers **132** so as to use frequencies greater than the upper limit of human hearing (approximately greater than 20 kHz). It may be appreciated that a number of conditions may be treated with ultrasounds, including, but not limited to ligament sprains, muscle strains, tendonitis, joint inflammation, plantar fasciitis, metatarsalgia, facet irritation, impingement syndrome, bursitis, rheumatoid arthritis, osteoarthritis, and scar tissue adhesion. Further, ultrasounds may be used in a number of biomedical applications such as breaking up stony deposits or tissue, and accelerating the effect of drugs in a targeted area as may be understood by a person having ordinary skill in the art. Further, the multisensory stimulation system **100** may include, but not be limited to element typically found in medical ultrasound devices such as a transducer, a transmitter pulse generator, compensating amplifiers, control units for focusing, digital processors and display monitor as would be understood by a person having ordinary skill in the art.

[0034] Ultrasound waves may be applied to tissues using a round-headed wand or transducer that is in direct contact with the user's skin. Gel may be used on all surfaces of the transducer's head to reduce friction and assist transmission of the ultrasonic waves. The waves may be generated by piezoelectric effect caused by the vibration of crystals within the head of the wand or probe. The ultrasonic waves that pass through the skin may cause a vibration of the local tissues. This vibration or cavitation may cause a deep heating locally though typically no perception of heat may be felt by the patient.

[0035] Therapeutic ultrasound in physical therapy may involve alternating compression and rarefaction of sound waves with a frequency of >20 KHz. Therapeutic ultrasound frequency used may be from approximately 0.7 MHz to approximately 3.3 MHz. The maximum energy absorption in soft tissue may occur from approximately 2 cm to approximately 5 cm. The intensity may decrease as the waves penetrate deeper and are absorbed by connective tissue: ligaments, tendons, and fascia (and also by scar tissue).

[0036] In an exemplary embodiment, illustrated in FIG. 6, the multisensory stimulation system **100** may use a 360 panner (for example, HRTF technologies) to send frequencies to different parts of the head and brain so as to virtually stimulate the targeted area. A 3D image (shown in FIG. 6) may be displayed on the application software display **106** or the virtual reality display **104** and the user may interact with the application software **110** and the image by using the joystick **160** or brainwaves. The 3D image may display information about the various parts of the brain. For example, stimulation of one of the four lobes **604** of the brain may help the user to focus. The stimulation parameters may be controlled in real time or may be set before the session begins. A unique surround panner may move the sounds toward the speakers **120** or the headphones may be part of the multisensory stimulation system **100** in order to move the sounds around the body so as to focus the sound on a specific body area. A pre-programmed session may circulate and steer the sound in a specific pattern over the body.

[0037] In another exemplary embodiment, a session focusing on treating the spine may deliver sounds and vibration directly to the spine. The sounds and vibrations may also move around the spine so as to release tension and to stimulate a specific area. Other pre-programmed sessions may focus on other areas of the body including, but not limited to the digestive system, lungs, heart, and scalp. The sound may travel over the meridians, energy points and other critical and potential points that may bring deep healing to those areas, as may be understood by a person of ordinary skill in the art.

[0038] In another exemplary embodiment illustrated in FIGS. 7A and 7B, the application software **110** may show views of the human body in the application software display **106** or in the virtual reality display **104**. The user may turn around, spin, and zoom in and out of the virtual body. Various structural and functional features of the body may be displayed with their corresponding names, for example: name of the main muscles, internal organs, bones, or chakras. Further, the user may get an explanation of how the body may be functioning by clicking on a specific body area. Further sounds may be directed to any desired location by selecting the target area on the image displayed.

[0039] In another exemplary embodiment, the multisensory stimulation system **100** may be designed as a portable device for personal use. The portable device may be controlled using a portable computing device such as, but not limited to, a smartphone or a tablet and may operate without additional audio device or soundwave generator. A main audio signal originating from the portable computing device may be duplicated into two identical audio signals, a first audio signal, and a second audio signal. The duplication, or splitting, of the main audio signal may be achieved, for example, by using a device similar to the devices commonly used to split an audio output for the simultaneous use of two sets of headphones. The first audio signal may pass through an analog or digital low pass filter so as to filter high frequencies and send only the low frequencies to a number of speakers **120**. The second audio signal may pass through an analog or digital high pass filter so as to send only high frequencies to headphones. It may be appreciated that any desired filters may be applied to the first audio signal and second audio signal as might be understood by a person having ordinary skill in the art. Further, the portable device designed for personal use may retain all the functions and benefits of the multisensory stimulation system **100**.

[0040] In another exemplary embodiment, ultrasound technology may be applied to show the user's actual internal body in real time, this functionality may allow physicians and healthcare specialists to visualize how the sounds and vibrations may affect the area. Medical imaging renditions and scans may be displayed in real time on the virtual reality display **104** or application software display **106**, as would be understood by a person having ordinary skill in the art. It may be appreciated that any desired technique such as, but not limited to, image integration and image augmentation may be implemented.

[0041] In a further exemplary embodiment, the user may visualize, select, and modify the session parameters using a joystick **160**, an EEG **130** feedback device, or any other desired technology that may allow reading the user's biometric signals or brainwaves and translating them into movement or to action in the environment. It may be appreciated that any systems capable of utilizing software or

devices with brainwaves may be connected to the multisensory stimulation system **100**, as may be understood by a person of ordinary skill in the art.

[0042] In an exemplary embodiment, a human body illustration may be displayed on the screen allowing the user to select a specific area to be treated. An external or digital joystick **160** may be used to navigate the application software **110**, and move in the virtual reality display **104** in real time during the session and direct stimulation to specific body area or to internal energy spots.

[0043] Any desired sensors may be connected to the multisensory stimulation system **100** and may send information back to the software application. Such sensors may include, but not be limited to, breathing monitor **133**, heart rate monitor **134**, or the like. Feedback from these sensors may affect the sound in real time or may just be documented for monitoring purposes.

[0044] In an exemplary embodiment, feedback from a breathing monitor **133** may be used to modify the session in real time according to the user breathing cycles. For example, when the breathing cycles are slow, the session may produce a quiet sound with low frequencies and low vibrations. This session setting may maintain the user's current state according to a predetermined session program. Further, random sounds may be selected according to feedback from the breathing monitors **133** and may fade in and out during the session. The multisensory stimulation system **100** may produce different tones and sounds to maintain or change a present state.

[0045] In an exemplary embodiment, the user may select a desired mood from the application software display **106** or through the virtual reality display **104** and the application may create a unique session to bring the user to the chosen mood. The application may also modify or create sounds and sessions according to a shape that the users may draw on the touchpad **170**.

[0046] In an exemplary embodiment, each session may be built like an original story or a journey with a start, a middle, and an end. The session may be divided into a number of time periods, for example, period 0 (zero) to period 10. Each period may have a specific duration and may be associated to a variety of sounds that may fade in. Periods may overlap and may be combined together depending on their functionalities. For example, period 1 may be at the beginning of the session, and may produce the first sound layers or vibrations. The session may be divided into percentages of the total duration, a full session may be 100%, and each period may correspond to predetermined percentages of the session. For example, the period 1 may correspond to the first 5% of the session and period two may be from approximately 5% to approximately 10%. Further, the duration of the session may be modified by the user at any time. When the user selects a different session duration, the new session duration may be set as 100% of the session and each period duration may be adjusted according to their relative percentages.

[0047] The application software **110** may propose games or tasks in the virtual reality display **104** that the user need to solve in order to improve a number of brain functionalities such as, but not limited to focus, memory, sharpness, and relaxation as may be understood by a person having ordinary skills in the art. During the session, the application software **110** may provide the user an option for active involvement in the narrative the story or for example to virtually walk to an area and move things or solve problems using brain-

waves. The session may be designed to heal, relax, sleep, rehabilitate, play, educate, and improve brain skills in general. The session may also provide tasks to improve post trauma issues such as fear. For example, in treating fear of height, the multisensory stimulation system **100** may bring the user to a cliff of a mountain in order to face his or her fear and be able to confront it for healing purposes. Similar fear such as aircraft flight, hospitals, water, and animals may be treated in a similar way.

[0048] In an exemplary embodiment, the main background sound may be changed by the actuation of a digital or analog button. For example, a forest sound may randomly be changed to an ocean sound. The multisensory stimulation system **100** may generate a random session every time and may be adapted for children or according to the user's needs. Further, the multisensory stimulation system **100** may separate vibrations and sounds that goes to the user headphones or to the speakers **120** into individual channels which may be controlled separately and bring more complexity and depth to the session. Further, the visuals shown on the virtual reality display **104** or on a software application display **106** may be synchronized with the sounds.

[0049] In at least one exemplary embodiment, the multisensory stimulation system **100** may release fragrances that may be associated with the visuals, for example if the user sees ocean visuals on the virtual reality display **104** or on the application software display **106**, the multisensory stimulation system **100** may produce ocean fragrances. It may be appreciated that any desired fragrance may be produced, such as, but not limited to, ocean, forest, mountain, city, farm, temple, flowers, and food, as may be understood by a person having ordinary skill in the art. The multisensory stimulation system **100** may include elements of digital scent technology, such as, but not limited to, olfactometers, electronic noses, scent generating devices, synthetic and natural odor cartridges, and aroma mixers, as may be understood by a person having ordinary skill in the art.

[0050] In another exemplary embodiment, unique sounds recordings during a walk in nature or in different places may bring movement and changing surrounding so as to keep the user focused when a state of awareness is required. Perceived movement may help disabled people with walking disabilities by activating the lobe in their brain controlling movement. The design of the multisensory stimulation system **100** may allow the user lay down, sit, stand, or move during the session.

[0051] In another exemplary embodiment, the multisensory stimulation system **100** may be adapted to a variety of structures such as, but not limited to, airplane body-supporting structures, gaming devices, vehicle seats, medical equipment, baby seat, baby beds, baby toys, office chairs, and personal beds. A connection kit may be utilized to adapt the multisensory stimulation system **100** to the user's furniture. The connection kit may include speakers **120**, and all the necessary hardware to connect the system to a built-in computer **112** or the user's personal computing device **114**. The multisensory stimulation system **100** may be portable, customizable, and may be adapted to be used and integrated with other systems, as may be understood by a person having ordinary skill in the art. In an exemplary situation, an aviation company may integrate part of the multisensory stimulation system **100** functionality and technology to their own vibroacoustic airplane seats or beds.

[0052] The foregoing description and accompanying figures illustrate the principles, preferred embodiments, and modes of operation of the invention. However, the invention should not be construed as being limited to the particular embodiments discussed above. Additional variations of the embodiments discussed above will be appreciated by those skilled in the art.

[0053] Therefore, the above-described embodiments should be regarded as illustrative rather than restrictive. Accordingly, it should be appreciated that variations to those embodiments can be made by those skilled in the art without departing from the scope of the invention as defined by the following claims.

What is claimed is:

1. A body-supporting structure for multisensory stimulation comprising:

- at least one biometric measurement device for detecting a user's state;
- at least one speaker connected to a resonator on the body-supporting structure and arranged to transfer an auditory stimulus in accordance with the state detected;
- at least one computing device connected to the biometric measurement device;
- a virtual reality display connected to the at least one computing device;
- at least one transducer rigidly connected to a resonator on the body-supporting structure;
- at least one input device connected to the at least one computing device; and
- at least one amplifier connected to the at least one input device and configured to transfer a signal to at least one of the at least one speaker and at least one transducer.

2. The body-supporting structure of claim 1, wherein the at least one biometric measurement device is at least one of a EEG system, an ultrasound transducer, a heart rate monitor, and a breathing monitor.

3. The body-supporting structure of claim 1, wherein the virtual reality display is a virtual reality headset.

4. The body-supporting structure of claim 1, wherein the at least one computing device is at least one of a smartphone, tablet, laptop, desktop and built-in computer.

5. The body-supporting structure of claim 1, wherein the at least one transducer produces ultrasounds at frequencies above 20,000 Hz.

6. The body-supporting structure of claim 1, wherein the at least one input device produces frequencies up to approximately 20,000 Hz.

7. The body-supporting structure of claim 1, wherein the body-supporting structure further comprises at least one of a heating blanket, a touchpad, and a joystick.

8. The body-supporting structure of claim 1, wherein the at least one input device is an oscillator.

9. The body-supporting structure of claim 9, wherein the oscillator is configured to produce binaural beats.

10. The body-supporting structure of claim 9, wherein the binaural beats are approximately 0.1 Hz to approximately 30 Hz.

11. A method for providing multisensory stimulation, comprising:

- providing a body-supporting structure;
- placing a user in physical contact with the body-supporting structure;
- measuring a user's state with at least one biometric measurement device;
- transferring an auditory stimulus in accordance with the state detected with at least one speaker connected to a resonator on the body-supporting structure;
- displaying a virtual reality display to the user;
- providing vibrations to the user through the structure from at least one transducer.

12. The method for providing multisensory stimulation of claim 11, wherein the at least one biometric measurement device is at least one of a EEG system, an ultrasound transducer, a heart rate monitor, and a breathing monitor.

13. The method for providing multisensory stimulation of claim 11, wherein the at least one transducer produces ultrasounds at frequencies above 20,000 Hz.

14. The method for providing multisensory stimulation of claim 11, wherein the at least one input device produces frequencies up to approximately 20,000 Hz.

15. The method for providing multisensory stimulation of claim 11, wherein the body-supporting structure further comprises at least one of a heating blanket, a touchpad, and a joystick.

16. The method for providing multisensory stimulation of claim 11, further comprising providing input control with an oscillator.

17. The method for providing multisensory stimulation of claim 16, wherein the oscillator is produces binaural beats.

18. The method for providing multisensory stimulation of claim 17, wherein the binaural beats are provided at approximately 0.1 Hz to approximately 30 Hz.

19. The method for providing multisensory stimulation of claim 11, wherein transferring an auditory stimulus in accordance with the state detected with at least one speaker connected to a resonator on the body-supporting structure further comprises transmitting different auditory stimuli to each of a plurality of speakers in accordance with the state detected.

20. The method for providing multisensory stimulation of claim 11, the transferring an auditory stimulus further comprising: creating a 360° sound space in the body supporting structure.

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专利名称(译)	多感觉刺激的装置，系统和方法		
公开(公告)号	US20170119994A1	公开(公告)日	2017-05-04
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当前申请(专利权)人(译)	Argaman、痛		
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IPC分类号	A61M21/00 A61B5/00 A61B5/024 A61B8/00 A61B5/0476 A61B5/08		
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摘要(译)

在示例性实施例中，可以提供用于多感觉刺激的身体支撑结构。用于多感觉刺激的身体支撑结构可包括用于检测用户状态的多个生物测量测量装置，以及连接到身体支撑结构上的谐振器并且被布置成根据检测到的状态传递刺激的多个扬声器或换能器。计算设备可以连接到生物测量测量设备和虚拟现实显示器。许多输入设备也可以连接到计算设备和多个放大器，这些放大器被配置为将信号传输到多个扬声器和换能器。

