Methods, Systems, and Computer-Readable Media for Treating a Subject

Devices and methods for providing medical treatment sessions to a subject are disclosed. The treatment sessions may comprise one or more parameters controllable by the subject in real time and one or more parameters that are remotely controllable in real time. The treatment session may be displayed at the patient's device. A user control module may alter one or more controllable parameters by the user. A communication module may be configured to transmit, in real time, the treatment session and information related to the controllable parameters to a remote device and receive instructions, in real time, from the remote device to alter said one or more remotely controllable parameters. A treatment control module may be configured to alter said one or more remotely controllable parameters during the treatment session in response to the received instructions.
METHODS. SYSTEMS. AND COMPUTER-READABLE MEDIA FOR TREATING A SUBJECT

This application claims the benefit of U.S. Provisional Patent Application Ser. No 61/938533 filed February 11, 2014.

The present disclosure relates to medical science and more specifically to methods, systems, and computer-readable media for treating a subject.

BACKGROUND ART

A phobia is a type of anxiety disorder, usually defined as a persistent fear of an object or situation in which the sufferer commits to great lengths in avoiding. A variety of treatments have been proposed for phobias. However, many of these treatments pose various side effects. Other treatments require expensive hardware devices that limit their usage to clinical environments.

It is desirable to provide treatments for anxiety disorders of a subject, such as phobias, that at least partially solve the above mentioned problems.

SUMMARY OF THE INVENTION

The present disclosure is most clearly understood with reference to the following definitions:

As used in the specification and claims, the singular form "a," "an," and "the" include plural references unless the context clearly dictates otherwise.

As used in the specification and claims, the terms "comprises," "comprising," "containing," "having," and the like can mean "includes," "including," and the like.
A "healthcare provider" shall be understood to mean any person providing medical care to a patient. Such persons include, but are not limited to, medical doctors, physician's assistants, nurse practitioners (e.g. an Advanced Registered Nurse Practitioner (ARNP)), therapists, nurses, residents, interns, medical students, or the like. Although various licensure requirements may apply to one or more of the occupations listed above in various jurisdictions, the term healthcare provider is unencumbered for the purposes of this patent application.

Unless specifically stated or obvious from context, as used herein, the term "or" is understood to be inclusive.

A "subject" shall be understood to include any mammal including, but not limited to, humans. The term "subject" can include all subsets of individuals within a particular class of subjects, e.g., males, females, infants, children, adolescents or adults.

In a first aspect a device for providing a medical treatment session to a subject is disclosed. The treatment session comprises one or more parameters controllable by the subject in real time and one or more parameters that are remotely controllable in real time. The device comprises a graphical user interface to display the treatment session, a user control module to alter said one or more controllable parameters by the user and a communication module. The communication module is configured to transmit, in real time, the treatment session and information related to the controllable parameters to a remote device and receive instructions, in real time, from the remote device to alter said one or more remotely controllable parameters.

The device further comprises a treatment control module configured to alter said one or more remotely controllable parameters during the treatment session in response to the received instructions.
By providing a real-time channel between the subject’s device and the remote device it is possible to provide a controlled treatment session even if the subject and the healthcare provider are remotely located.

In some examples the subject’s treatment session may be progressive exposure to one or more selected from virtual reality experiences, augmented reality experiences, video, and photographs, via the device. Exposure therapy identifies the effects of the patient to the fear-induced stimulus and breaks response through measured exposure until habituation is achieved. Using a hierarchic methodology of fearful stimuli, the subject is trained on how to cope with the situation with a gradual exposure. Exposure techniques consist on coping, in a systematic way, with situations (such as public speaking or petting a dog) or internal stimuli (such as dizziness or concerns).

Virtual reality sessions can utilize digital methods and a headset to: create virtual stimuli and situations in a computerized environment, simulate passed experiences such as real experiences, exaggerate the response, and/or expose the subject in a very controlled environment.

The advantages of VR exposure include: subject preferences for the controlled nature of VR exposure prior to real exposures, the repeatability and extensibility of VR exposure, its avoidance of imaginative exposure problems, its increased degree of presence and immersion, its ability to complement real exposure or serve as an alternative to it (especially when real exposure is difficult to conduct), and its ability to be used as behavioral tests.

The limitations of VR exposure are: the economic cost, difficulties of some patients in experiencing a sufficiently immersive sensation, potential dizziness during the exposition process, potential side effects (e.g. headache, sleepiness, fatigue, and walking problems), contraindications or warnings for subjects with heart conditions, epilepsy, convulsions, or patients under substance abuse.
VR exposure performs better than no treatment. Moreover, results have shown that VR exposure, in combination with cognitive restructuring and self-exposure provides improved results in treating generalized social phobia.

Augmented reality exposure applies overlapping virtual images, e.g. a spider, to real time images. To achieve it, the virtual reality handset is modified to incorporate a camera. This camera records the surrounding real world. The video images are processed and virtual elements are incorporated to the image. The whole scenario, video plus virtual images, is shown on the headset monitor. Using this method, the patient gets and feels important stimuli that do not exist on the real world. As a result, the degree of presence is highly improved, so that the situation is more realistic and the degree of presence is increased.

In some examples, said real-time information is the subject’s biofeedback response. Biofeedback sensors may sense the biofeedback response of the subject and be connected to the device to provide said biofeedback response during a treatment session. The subject’s device may comprise or be connected to one or more biofeedback sensors measuring physiological parameters of the subject. The one or more biofeedback sensors may comprise sensors to measure one or more of a skin conductance, a heart rate, a heart rate variability, temperature and blood pressure. The subject’s device may transmit the measured physiological parameters to the healthcare device.

In some examples, said instructions may comprise instructions to alter the intensity of an exposure session. For example the rate in which images change, or a sound level, or a color intensity etc.

In some examples, the treatment session may be a session for treating a phobia. The phobia may be selected from the group consisting of: ablutophobia, achluophobia, acrophobia, agoraphobia, agraphobia, agrizoophobia agyrophobia aichmophobia, ailurophobia, algophobia,
amyophobia, androphobia, anthophobia, anthropophobia, aquaphobia, arachnophobia, astraphobia, atychiphobia autophobia, automatonophobia, aviophobia, aviatophobia, barophobia, chaetophobia, chemophobia, chiroptophobia, chromophobia, chronophobia, cibophobia, sitiophobia claustraphobia, cleithrophobia, coulrophobia, cyberphobia, decidophobia, dentophobia, disposophobia, dysmorphophobia, emetophobia, ergasiophobia, ergophobia, erotophobia erythrophobia, friggatriskaidekaphobia, paraskavedekatnaphobia, paraskevidekatnaphobia frigophobia gamophobia, gelotophobia, gephyrophobia, genophobia, gerascophobia, gerontophobia, globophobia, glossophobia, gymnophobia, gynophobia, hadephobia, halitophobia, haphephobia, heliophobia, hemophobia, haemophobia, hexakosioihexekontahexaphobia, hoplophobia, hylophobia, hypnophobia, somniphobia, ichthyophobia, koumpounophobia, lipophobia, melissophobia, musophobia, murophobia, suriphobia, myrmecophobia, mysophobia, necrophobia, neophobia, cainophobia, cainotophobia, centophobia, kainolophobia, kainophobia, nomophobia, nosocomophobia, nosophobia, nyctophobia, achluophobia, lygophobia, scotophobia, obesophobia, oikophobia, ombrophobia, omphalophobia, ophthalmophobia, ornithophobia, osmophobia, olfactophobia, panphobia, papaphobia, pediophobia, phagophobia, pharmacophobia, philophobia, photophobia, phonophobia, pogonophobia, pyrophobia, radiophobia, sesquipedalophobia, scopophobia, sociophobia, somniphobia, spectrophobia, stygiophobia, taphophobia, technophobia, telephone phobia, tetraphobia, thalassophobia thanatophobia, thermophobia, tokophobia, traumatophobia, triskaidekaphobia, terdekaphobia, trypanophobia, belonephobia, enetophobia, trypophobia, turophobiauranophobia, ouranophobia, workplace phobia, xanthophobia, xenophobia, xylophobia, and ylophobia. However, any other type of phobia may benefit from the techniques disclosed herein.

In some examples, the session may be a session for treating one or more conditions selected from the group consisting of: addiction, anorexia nervosa, anxiety, an anxiety disorder, autism, bulimia, depression, eating disorders,
hyperactivity, impulsive behaviors, low motivation, obsessive-compulsive behaviors, overeating, panic attacks, schizophrenia, a social disorder, a speech disorder, stress mismanagement, post-traumatic stress disorder (PTSD) and substance abuse.

In some examples, the device of the subject may be a communication device, wired or wireless. A communication device, such as a mobile phone, a smartphone or a tablet, may comprise a display to provide a treatment session to the subject irrespective of the location of the subject. The device may comprise a display to provide a simulated session associated with the subject’s treatment session. Therefore, it is not only possible to have a treatment session at a location away from where the healthcare provider is located, but also without having to use any hardware devices that their usage may be limited to clinical environments.

In some examples, the communication device of the subject may be mounted on a headset. It may also be programmed to produce sound. This may allow sessions with virtual reality, augmented reality and/or visual tools optionally combined with holophonic sound to be experienced with the device.

In some examples the device of the subject may be programmed to expose the subject to one or more treatable conditions of the subject. Therefore, each device may be custom programmed to provide content that is tailor made for the subject. An application may be loaded on the subject’s device that may provide sessions related to the subject’s treatable conditions.

In some examples the treatment session may be a training session. The device may monitor the progress of the subject and provide varying levels of exposure during a series of sessions.

In some examples the real-time information may comprise images or videos as viewed on the device of the subject. The device may be configured to transmit said real-time information to the remote device to mirror the session as viewed at the device of the subject. Therefore, the healthcare provider may
be able to see exactly what the subject is viewing on his/her device and monitor the session in real time.

In some examples, the real-time information may further comprise interactions of the subject with the device. Therefore, the remotely located healthcare practitioner may also receive the interactions of the subject that may indicate the subject’s response to the treatment.

In another aspect, a healthcare device for remotely monitoring and controlling a treatment session of a subject by a healthcare practitioner is disclosed. The treatment session may be provided at a device of the subject. The treatment session may comprise one or more parameters controllable by the subject in real time and one or more parameters that are remotely controllable in real time by the healthcare device. The healthcare device may comprise a graphical user interface, a control interface and a communication module. The graphical user interface may comprise a display to mirror the treatment session as displayed at the subject’s device and an information area, where information related to the response of the subject to the treatment may be displayed. The control interface may comprise controls allowing the healthcare practitioner to input instructions to alter one or more remotely controlled parameters of the treatment session. The communication module may be configured to receive the treatment session and information related to the remotely controllable parameters and transmit instructions to the subject’s device to alter said one or more remotely controllable parameters based on the input of the healthcare practitioner at the control interface. The healthcare device allows a practitioner to remotely monitor and control a treatment session irrespective of the location of the subject and/or the practitioner.

In some examples the healthcare device may comprise controls associated with the one or more parameters of the subject’s treatment session, wherein the healthcare module receives interaction information when a healthcare practitioner interacts with said controls and transmits control information to the subject’s device to alter the one or more parameters in response to said
received interaction information. Therefore the healthcare practitioner may control in real-time parameters of the treatment session based on the response of the subject.

In another aspect, a treatment system for a medical condition is disclosed. The treatment system may comprise a subject’s device and a healthcare device according to examples disclosed herein. Furthermore, the treatment system may comprise a central platform, connected to the wireless device and to the healthcare device. The central platform may be configured to receive the treatment session and information related to the controllable parameters from the wireless device and transmit them to the healthcare device, and receive the instructions from the healthcare device and transmit them to the wireless device. The central platform may control the flow of information between the subject’s device and the healthcare device. It may also apply security protocols and in some examples it may interface between potentially incompatible devices of the subject and of the healthcare provider. Furthermore, it may enrich the information that the healthcare provider views at his device with e.g. statistical or historical information of the subject and/or of other subjects with e.g. similar sessions.

The central platform may be connected to the subject’s device and/or to the healthcare device via a full duplex communication protocol. The full duplex communication protocol may be a websocket protocol. Therefore, real-time information may be exchanged between the subject’s device and the healthcare device securely and without delay.

In yet another aspect, a method of providing a treatment session to a subject is disclosed. The treatment session may comprise one or more parameters controllable by the subject in real time and one or more parameters that are remotely controllable in real time. The method may comprise: displaying the treatment session with a graphical user interface at a subject’s device; controlling said one or more user controllable parameters with a control module of the user device; transmitting the treatment session and information
related to the controllable parameters to a remote device; receiving at the subject's device instructions transmitted from the remote device to alter said one or more remotely controllable parameters; and altering said one or more remotely controllable parameters in response to the received instructions.

In some examples the method may further comprise exposing the subject to a plurality of sessions including one or more selected from the group consisting of: virtual reality experiences, augmented reality experiences, video, and photographs, via a mobile device; monitoring the subject's biofeedback response; transmitting, in real time, the treatment session and information related to the controllable parameters to a remote device; and receiving instructions, in real time, from the remote device to alter said one or more remotely controllable parameters.

In some examples, the method may further comprise increasing or decreasing the intensity of one or more subsequent exposure sessions based on the subject's biofeedback response.

In some examples the method may be performed in conjunction with a medical procedure. The medical procedure is selected from the group consisting of: chemotherapy, chronic pain therapy, dental procedures, psycho-oncology therapy, surgical procedures, and therapy. The combined effect may accelerate treatment.

In some examples the method may be a training method. The training method may relate to one or more selected from the group consisting of: first aid, medical procedures, and workplace risk prevention.

In yet another aspect, a computing device is disclosed. The computing device may comprise a memory and a processor. The memory may store computer program instructions executable by the processor. Said instructions may comprise functionality to execute a method of providing a treatment session to a subject according to examples disclosed herein.
In yet another aspect, a computer program product is disclosed. The computer program product may comprise instructions to provoke that a computing device implements a method of providing a treatment session to a subject according to examples disclosed herein.

The computer program product may be embodied on a storage medium (for example, a CD-ROM, a DVD, a USB drive, on a computer memory or on a read-only memory) or carried on a carrier signal (for example, on an electrical or optical carrier signal).

The computer program may be in the form of source code, object code, a code intermediate source and object code such as in partially compiled form, or in any other form suitable for use in the implementation of the processes. The carrier may be any entity or device capable of carrying the computer program.

For example, the carrier may comprise a storage medium, such as a ROM, for example a CD ROM or a semiconductor ROM, or a magnetic recording medium, for example a hard disk. Further, the carrier may be a transmissible carrier such as an electrical or optical signal, which may be conveyed via electrical or optical cable or by radio or other means.

When the computer program is embodied in a signal that may be conveyed directly by a cable or other device or means, the carrier may be constituted by such cable or other device or means.

Alternatively, the carrier may be an integrated circuit in which the computer program is embedded, the integrated circuit being adapted for performing, or for use in the performance of, the relevant methods.

Additional objects, advantages and features of embodiments of the invention will become apparent to those skilled in the art upon examination of the description, or may be learned by practice of the invention.
BRIEF DESCRIPTION OF THE DRAWINGS

Particular embodiments of the present invention will be described in the following by way of non-limiting examples, with reference to the appended drawings, in which:

Fig. 1 depicts a subject’s device according to an example.
Fig. 2 depicts an example application of the subject’s device
Fig. 3 depicts the use of the accelerometer of the subject’s device
Fig. 4 depicts a subject-healthcare provider scenario
Fig. 5 depicts a practitioner’s device according to an example
Fig. 6 depicts an example of the invention facilitating augmented reality.
Fig. 7 depicts an example device in the form of a kit.
Fig. 8 provides an exemplary data flow within a virtual reality embodiment of the invention.
Fig. 9 depicts a network implementation according to an example.
Fig. 10 provides an exemplary flow chart for a self-treatment application.
Fig. 11 depicts a sample progression from virtual reality sessions to augmented reality sessions to real exposure.
Fig. 12 depicts exemplary hardware and software components.
Fig. 13 depicts an exemplary flow chart for simulating an airplane flight.
Fig. 14 depicts a progression of a treatment according to an example.

DETAILED DESCRIPTION OF EMBODIMENTS

Referring now to Fig. 1, one embodiment of the invention provides a subject’s device including a headset 1, a mobile device 2, and a set of headphones 3. The mobile device 2 may be a smartphone, for example, a device sold under the IPHONE® trademark by Apple, Inc. of Cupertino, California, the WINDOWS® trademark by Microsoft Corporation of Redmond Washington,
the ANDROID® trademark by Google Inc. of Mountain View, California, and
the like. Headsets 1 capable of removably receiving a smartphone are
available under the VRASE® trademark from vrAse Corp. of Edinburgh,
Scotland; under the DUROVIS® DIVE® trademark from Shoogee GmbH &
Co. KG of Munster, Germany; and under the 3D DIRECTOR® mark from 3D-
Director of Hong Kong. The above mentioned devices are mere examples of
devices that may be used. The devices may be programmed to provide a
medical treatment session to a subject.

As seen in Fig. 2, headset 1 may confine the subjects field of vision 4 to a
portion of the image 5 displayed by the smartphone. Embodiments of the
invention can also utilize the one or more accelerometers in a smartphone in
order to assess the subjects yaw, pitch, and roll as depicted in Fig. 3.

Referring now to Fig. 4, a healthcare provider 12 may monitor and/or control
the treatment of the subject 13 via a healthcare computing device 8. Computing device 8 can, for example, be a personal computer or a
smartphone. Computing device 8 can be in wired or wireless communication
with one or more devices utilized by subject 13 including, for example, mobile
device 10, headphones 11, or one or more devices (e.g. biofeedback
sensors) for monitoring the subject’s anxiety. Such communications may be
facilitated by a wireless link 9, which can, for example, utilize WI-FI®,
BLUETOOTH®, or another wireless standard. Furthermore, the link 9
between the subject and the healthcare provider may be a remote link. The
subject and the healthcare provider may not be physically located in the same
room or area.

As seen in Fig. 5, computing device 8 may, in some embodiments, be a
handheld communication device having a graphical user interface. The
graphical user interface may, in some embodiments, provide a display 15
showing whatever the subject is viewing on mobile device 10, one or more
icons 14 for controlling the treatment, and one or more graphs of the patients anxiety (e.g., measured by the State-Trait Anxiety Inventory) or a proxy thereof (e.g., blood pressure, pulse, breathing rate, sweat, etc.).

Fig. 6 depicts an embodiment of the invention facilitating augmented reality. Mobile device 17 may include a camera adapted, configured, and/or programmed to obtain video images of the subject's viewpoint, which may include an object 18 on a table. Healthcare provider may utilize software on the mobile device 17 to superimpose a phobia-causing object (e.g., a spider) over the video stream shown to the subject. Healthcare provider may view the subject's video stream using handheld computing device 20, which can in some embodiments be a tablet computer.

Referring now to Fig. 7, another aspect of the invention provides a kit including a mobile device 21 (e.g., a smartphone), software 22 (e.g., an application or app) for installation on mobile device 21, and a headset 23 adapted and configured to removably receive mobile device 21.

Fig. 8 provides an exemplary data flow within a virtual reality embodiment of the invention. Mobile sensors data (e.g., accelerometer data) may be obtained by the app 80 from the mobile device (smartphone or tablet) 82. This data may be used to manipulate the visualization displayed to the subject on the mobile screen 84. For example, if the mobile sensors indicate the subject is looking down, the virtual reality display may pan down.

Referring now to Fig. 9, embodiments of the invention may utilize a networked environment in order to facilitate communication between a subject and a healthcare provider. For example, information about the subject's treatment session may be communicated to a central platform (e.g. a cloud environment) 90 for storage, query, and viewing by the subject 92 and/or the healthcare provider 94. This information may be transmitted from the
healthcare provider’s office 9 or from the subject’s home or workplace. Parameters for real-time or future treatment sessions may be set by the healthcare provider and transmitted to the subject’s device via the networked environment. The central environment may also generate reminders for future sessions and/or alert the healthcare provider if desired results are not achieved.

In one scenario, the subject may be located at his house or office and may select a treatment session at his/her device, e.g. smartphone. When the treatment session is selected, a websocket may be established between the subject’s device and the healthcare provider’s device. This websocket may be controlled through the central platform. The subject may initiate the session based on pre-stored parameters at the subject’s device or based on parameters prepared at the healthcare provider’s device and sent to the subject’s device through the websocket. The subject may then initiate the session. He is then progressively exposed to an experience, e.g. a virtual reality experience, related to e.g. a phobia. As the session unfolds in time, the subject may view the session at the subject’s device and may interact with the session with a control module. A number of biofeedback sensors may be attached to the subject and connected to the subject’s device to monitor a number of parameters such as skin conductance, heart rate, heart rate variability, temperature and/or blood pressure. At the same time, the healthcare provider may view a mirrored version of the session as communicated through the platform. Furthermore, the healthcare provider may receive data measured by the biofeedback sensors. Based on the information received at the healthcare provider’s device, the healthcare provider may use a control module at the healthcare provider’s device to change one or more parameters of the session. For example, the healthcare provider may increase or decrease the intensity of exposure of the subject to the object of the subject’s phobia.
In another scenario, the platform may be configured to automatically send predetermined instructions, e.g. sets of parameters, based on the progress of the subject and/or the measurements received from the biofeedback sensors. In yet another scenario, the app may be configured to automatically change the session’s parameters based on the progress of the subject and/or the measurements of the biofeedback sensors.

Fig. 10 provides an exemplary flow chart for a self-treatment application. A self-treatment app program may begin in step 100. Then, in step 101, the initial level of anxiety of the subject is assessed. Then in step 102, the treatment is designed and the sessions are scheduled. In step 103, a next exposure session is selected. In step 104, during the selected session, the anxiety rate is monitored. In decision box 105, the healthcare provider may decide to increase or not the exposure of the subject. If the healthcare provider judges that the exposure should be increased then the exposure is increased in step 106. If the healthcare provider judges that the exposure should not be increased, then, in decision box 107, the healthcare provider may decide to decrease or not the exposure of the subject. If the healthcare provider judges that the exposure should be decreased then the exposure is decreased in step 107. The process may then continue again from step 103 with a next exposure session.

Referring now to Fig. 11, a sample progression from virtual reality sessions to augmented reality sessions to real exposure is depicted. Each successive session may be associated with the frightening level of the exposure until real exposure is reached.

Referring now to Fig. 12, exemplary hardware 120 and software 121 components are depicted. A Therapist or APP assistant 122 may be treating a patient 123. The therapist may be provided with a controller 124 that may optionally be part of a communication device. This controller may be in real
time full duplex communication with a smartphone or tablet 125 of the patient. The patient may also use a headset display and earphones 126. The software 121 may comprise the cloud web platform 127 and the apps (virtual exposure apps toolbox 128).

Referring now to Fig. 13, an exemplary flow chart for simulating an airplane flight is depicted. The various states of the airplane may be simulated. In box 1305, the plane is considered at gate with its engines off. Then in box 1310, the engines are switched on. In box 1315, the next simulation state is the plane’s transition to taxiing. In box 1320, taxiing may start. Then in box 1325, the plane may be simulated to be in the runway. In box 1330, the plane is simulated with its engines full preparing for takeoff. In box 1335, the takeoff is simulated to be smooth. In box 1340, a rough takeoff is simulated. Then in box 1345, a good flight is simulated. In boxes 1350, 1355, 1360, an alternation of the flight’s simulated state may take place between a rough flight and a good flight. This part of the simulation may be remotely controllable by the device of the healthcare provider. In box 1365 the plane may approach landing. In box 1370 a good landing is simulated while in box 1375 a rough landing is simulated. Again, this part may be remotely controllable by the healthcare provider’s device. In box 1380, the plane may be simulated at the runway. Then, there are two options, either the simulation may end in box 1385, or the simulation may transition from landing to taxiing in box 1390 and a new flight simulation may start.

Referring now to Fig 14, an exemplary progression is shown utilizing embodiments of the invention. In box 142, a phobia or a pathological fear may be detected. Then, in box 144, a virtual reality gradual exposure may start. In box 146, the patient may reach a habituation state. Finally, in box 148, the patient may reach self-control in real exposure.

Exemplary Self-Treatment App
An exemplary progression is provided below:

- **Session 1** (virtual reality) duration (20 minutes) - The virtual reality environment may simulate a waiting room of a hospital. The ambient sound and the animations may show other people waiting for a medical procedure. The A.I. assistant of the app teaches several relaxations techniques.

- **Session 2** (virtual reality) duration (20 minutes) - The same virtual reality environment than in the session 1, but this time, the program or the healthcare provider remotely may add an accelerated heartbeat plus panting sound effect. An assistant may help the user to practice the anxiety control techniques.

- **Session 3** (virtual reality) duration (20 minutes) - The same virtual reality environment and effects than in the session 2. Also, during the simulation the program may distort the image producing a dizziness effect. The assistant helps the user to practice the anxiety control techniques.

- **Session 4** (virtual reality) duration (10 minutes) - The virtual reality environment simulates a blood extraction room where a nurse extract the subjects blood. The process may be seen by the subject as an observer who accompanies a person whose blood is extracted. The assistant may teach some new relaxation techniques.

- **Session 5** (virtual reality) duration (20 minutes) - The virtual reality environment may simulate a blood extraction room where a nurse may extract the subject’s blood. The process is seen by the subject as an observer who accompanies a person whose blood is extracted. This time the program may add the sound and dizziness effect, and force
the subject to look at the extraction. The assistant may help the subject to practice the anxiety control techniques.

- Session 6 (virtual reality) duration (20 minutes) - The virtual reality environment may simulate a blood extraction room where a nurse may extract the subject’s blood. The process may be seen in first person, as if the subject is being punctured. The assistant may help the subject to practice the anxiety control techniques.

- Session 7 (augmented reality) duration (10 minutes) - The subject may experience a virtual blood extraction in its own arm. The assistant may help the subject to practice the anxiety control techniques.

- Session 8 (point-of-view video) duration (10 minutes) - The subject may watch a first person video in which a person may be subjected to a blood extraction. The assistant helps the subject to practice the anxiety control techniques.

- Real blood extraction may take place

Embodiments of the invention are advantageous for at least the following reasons:

a self-treatment app may allow a subject to treat their phobias and anxiety disorders at home by means of systematic desensitization therapies with gradual virtual exposure;

the technology may combine virtual reality, augmented reality, and holophonics in a single therapy in order to gradually and virtually expose the subject to a situation to desensitize the subject;

the toolbox for therapists may allow them to remotely control the virtual exposure app used by the subject (at home or in the office); and

a smartphone may be used as a virtual reality device without need of
any other electronic device or hardware.

Additionally, embodiments of the invention provided herein may be unique in that:

virtual reality may be used in mobile platforms to treat conditions discussed herein;

virtual reality may be used in mobile platforms to carry the trainings discussed herein;

augmented reality may be used in mobile platforms to treat the illnesses discussed herein;

augmented reality may be used in mobile platforms to carry the trainings discussed herein;

virtual reality, augmented reality, and visual tools may be combined in the healthcare and/or wellness space;

holophonic sound may be used in mobile platforms to treat the illnesses discussed herein;

holophonic sound may be used in mobile platforms to carry the trainings discussed herein;

mobile platform-based technologies that connect with a web-based platform may be used on the healthcare provider's office in combination with VR, AR, audiovisual tools, and holophonic sound; and

a mobile-based platform capable of tracking patients with mental healthcare illness after therapy.

Although only a number of particular embodiments and examples have been disclosed herein, it will be understood by those skilled in the art that other alternative embodiments and/or uses and obvious modifications and equivalents thereof are possible. Furthermore, the disclosure covers all possible combinations of the particular embodiments described. Thus, the scope of the disclosure should not be limited by particular embodiments.
Further, although the examples described with reference to the drawings comprise computing apparatus/systems and processes performed in computing apparatus/systems, the disclosure also extends to computer programs, particularly computer programs on or in a carrier, adapted for putting the system into practice.
CLAIMS

1. A device for providing a medical treatment session to a subject, the treatment session comprising one or more parameters controllable by the subject in real time and one or more parameters that are remotely controllable in real time, comprising:
   - a graphical user interface to display the treatment session;
   - a user control module to alter said one or more controllable parameters by the user;
   - a communication module, configured to:
     - transmit, in real time, the treatment session and information related to the controllable parameters to a remote device;
     - receive instructions, in real time, from the remote device to alter said one or more remotely controllable parameters; and
   - a treatment control module configured to alter said one or more remotely controllable parameters during the treatment session in response to the received instructions.

2. The device according to claim 1, wherein the subject's treatment session is progressive exposure to one or more selected from virtual reality experiences, augmented reality experiences, video, and photographs, via the device

3. The device according to claim 1 or 2, wherein said real-time information is the subject's biofeedback response.

4. The device according to any of claims 1 to 3, wherein said instructions comprise instructions to alter the intensity of an exposure session.

5. The device according to any of claims 1 to 4, wherein the treatment session is a session for treating a phobia.
6. The device according to claim 5, wherein the phobia is selected from the group consisting of: ablutophobia, achluophobia, acrophobia, agoraphobia, agraphobia, agrizoophobia, agryrophobia, aichmophobia, ailurophobia, algophobia, amychophobia, androphobia, anthropophobia, aquaphobia, arachnophobia, astraphobia, atychiphobia, autophobia, automatonophobia, aviophobia, aviatophobia, barophobia, chaetophobia, chemophobia, chiroptophobia, chromophobia, chronophobia, cibophobia, sitophobia, claustrophobia, cleithrophobia, coulrophobia, cyberphobia, decidophobia, dentophobia, disposophobia, dysmorphophobia, emetophobia, ergasiophobia, ergophobia, erotophobia, erythrophobia, friggatriskaidekaphobia, paraskavedekatnaphobia, paraskevidekatanaphobia, frigophobia, gamophobia, gelophobia, gepyrophobia, genophobia, gerascophobia, gerontophobia, globophobia, glossophobia, gymnophobia, gynophobia, hadephobia, halitophobia, haphephobia, heliophobia, hemophobia, haemophobia, hexakosioihexekontahexaphobia, hoplophobia, hylophobia, hypnophobia, somniphobia, ichthyophobia, koumpounophobia, lipophobia, melissophobia, musophobia, murophobia, suriphobia, myrmecophobia, mysophobia, necrophobia, neophobia, cainophobia, cainotophobia, centophobia, kainolophobia, kainophobia, homophobia, nosocomophobia, nosophobia, nyctophobia, achluophobia, lygophobia, scotophobia, obesophobia, oikophobia, ombrophobia, omphalophobia, ophthalmophobia, ornithophobia, osmophobia, olfactophobia, panphobia, papaphobia, pediophobia, phagophobia, pharmacophobia, philophobia, phobophobia, phonophobia, pagonophobia, pyrophobia, radiophobia, sesquipedalophobia, scopophobia, sociophobia, somniphobia, spectrophobia, stygiophobia, taphophobia, technophobia, telephone phobia, tetraphobia, thalassophobia, thanatophobia, thermophobia, tokophobia, traumatophobia, triskaidekaphobia, terdekaphobia, trypanophobia, belonephobia, enetophobia, trypophobia, turophobia, uranophobia, ouranophobia, workplace phobia, xanthophobia, xenophobia, xylophobia, and ylophobia.
7. The device according to any of claims 1 to 4, wherein the session is a session for treating one or more conditions selected from the group consisting of: addiction, anorexia nervosa, anxiety, an anxiety disorder, autism, bulimia, depression, eating disorders, hyperactivity, impulsive behaviors, low motivation, obsessive-compulsive behaviors, overeating, panic attacks, schizophrenia, a social disorder, a speech disorder, stress mismanagement, post-traumatic stress disorder (PTSD) and substance abuse.

8. The device according to any of claims 1 to 7, wherein the device of the subject is a communication device.

9. The device according to claim 8, wherein the communication device of the subject is mounted on a headset.

10. The device according to any of claims 1 to 9, wherein the device of the subject is programmed to produce sound.

11. The device according to any of claims 1 to 10, wherein the device of the subject is programmed to expose the subject to one or more treatable conditions.

12. The device according to any of claims 1 to 11, wherein the treatment session is a training session.

13. The device according to any of claims 1 to 3, wherein the real-time information comprises images or videos as viewed on the device of the subject.

14. The device according to any of claims 1 to 13, wherein the real-time information further comprises interactions of the subject with the device.
15. The device according to any of claims 1 to 14, wherein the device is configured to transmit said real-time information to the remote device to mirror the session as viewed at the device of the subject.

16. The device according to any of claims 1 to 15, wherein the graphical user interface comprises a display to provide a simulated session associated with the subject’s treatment session.

17. The device according to any of claims 1 to 16, wherein the simulated session is one or more of a virtual reality, augmented reality and visual tools optionally combined with holophonic sound.

18. A healthcare device for remotely monitoring and controlling a treatment session of a subject by a healthcare practitioner, the treatment session provided at a device of the subject, the treatment session comprising one or more parameters controllable by the subject in real time and one or more parameters that are remotely controllable in real time by the healthcare device, the healthcare device comprising:

a graphical user interface comprising:

- a display to mirror the treatment session as displayed at the subject’s device;
- an information area, where information related to the response of the subject to the treatment is displayed;

- a control interface, comprising controls allowing the healthcare practitioner to input instructions to alter one or more remotely controlled parameters of the treatment session;

- a communication module, configured to
  - receive the treatment session and information related to the remotely controllable parameters;
  - transmit instructions to the subject’s device to alter said one or
more remotely controllable parameters based on the input of the healthcare practitioner at the control interface.

19. The healthcare device according to claim 18, wherein the healthcare device comprises controls associated with the one or more parameters of the subject's treatment session, wherein the healthcare module receives interaction information when a healthcare practitioner interacts with said controls and transmits control information to the subject's device to alter the one or more parameters in response to said received interaction information.

20. A treatment system for a medical condition, comprising:
   a subject's device according to any of claims 1 to 17;
   a healthcare device according to any of claims 18 to 19;
   a central platform, connected to the wireless device and to the healthcare device;
   wherein the central platform is configured to receive the treatment session and information related to the controllable parameters from the wireless device and transmit them to the healthcare device, and receive the instructions from the healthcare device and transmit them to the wireless device.

21. A treatment system according to claim 20, wherein the subject's device is connected to one or more biofeedback sensors measuring physiological parameters of the subject.

22. A treatment system according to claim 21, wherein the one or more biofeedback sensors comprises sensors to measure one or more of a skin conductance, a heart rate, a heart rate variability, a temperature and a blood pressure.
23. A treatment system according to claim 22, wherein the subject's device transmits the measured physiological parameters to the healthcare device.

24. A treatment system according to any of claims 20 to 23, wherein the central platform is connected to the wireless device and/or to the healthcare device via a full duplex communication protocol.

25. A treatment system according to claim 24, wherein the full duplex communication protocol is a websocket protocol.

26. A method of providing a treatment session to a subject, the treatment session comprising one or more parameters controllable by the subject in real time and one or more parameters that are remotely controllable in real time, comprising:
   - displaying the treatment session with a graphical user interface at a subject's device;
   - controlling said one or more user controllable parameters with a control module of the user device;
   - transmitting the treatment session and information related to the controllable parameters to a remote device;
   - receiving at the subject's device instructions transmitted from the remote device to alter said one or more remotely controllable parameters; and
   - altering said one or more remotely controllable parameters in response to the received instructions.

27. A method for providing a medical treatment session to a subject, the treatment session comprising one or more parameters controllable by the subject in real time and one or more parameters that are remotely controllable in real time, comprising:
   - exposing the subject to a plurality of sessions including one or more selected from the group consisting of: virtual reality experiences, augmented
reality experiences, video, and photographs, via a mobile device;
monitoring the subject's biofeedback response.
transmitting, in real time, the treatment session and information related
to the controllable parameters to a remote device;
receiving instructions, in real time, from the remote device to alter said
one or more remotely controllable parameters.

28. The method according to claim 27, further comprising increasing or
decreasing the intensity of one or more subsequent exposure sessions based
on the subject's biofeedback response.

29. The method according to any of claims 27 or 28, wherein the method is
performed in conjunction with a medical procedure.

30. The method according to claim 29, wherein the medical procedure is
selected from the group consisting of: chemotherapy, chronic pain therapy,
dental procedures, psycho-oncology therapy, surgical procedures, and
therapy.

31. The method according to any of claims 27 to 30, wherein the method
is a training method.

32. The method according to claim 131, wherein the training method
relates to one or more selected from the group consisting of: first aid, medical
procedures, and workplace risk prevention.

33. A computing device comprising a memory and a processor, wherein
the memory stores computer program instructions executable by the
processor, said instructions comprising functionality to execute a method of
providing a treatment session to a subject according to any of claims 27 to 32.
34. A computer program product comprising instructions to provoke that a computing device implements a method of providing a treatment session to a subject according to any of claims 21 to 24.
Fig. 9
EXPOSURE TREATMENT SESSIONS EXAMPLE

FRIGHTENING LEVEL

SESSIONS

* THE TECHNOLOGY USED IN EACH SESSION MAY VARY DEPENDING ON THE TREATMENT

Fig. 11
Fig. 14

142 PHOBIAS OR PATHOLOGICAL FEAR
144 VIRTUAL GRADUAL EXPOSURE
146 HABITUATION
148 SELF CONTROL IN FINAL EXPOSURE
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

INV. G06F19/00

ADD.

According to International Patent Classification (IPC) onto both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Wo 99/06981 AI (UNIV EMORY [US] ; GEORGIA INST OF TECHNOLOGY [US]) 11 February 1999 (1999-02-11) page 4, line 1 - page 6, line 33 page 20, line 5 - page 27, line 26 page 13, line 10 - page 14, line 33 figures 1-16</td>
<td>1-34</td>
</tr>
</tbody>
</table>

* Further documents are listed in the continuation of Box C.

* See patent family annex.

* "A" document defining the general state of the art which is not considered to be of particular relevance

* "E" earlier application or patent but published on or after the international filing date

* "L" document which may throw doubts on priority claim(s) on which it is cited to establish the publication date of another citation or other special reason (as specified)

* "O" document referring to an oral disclosure, use, exhibition or other means

* "P" document published prior to the international filing date but later than the priority date claimed

* "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

* "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve inventiveness when the document is taken alone

* "Y" document of particular relevance; the claimed invention cannot be considered to involve invention step when the document is taken alone

* "Z" document member of the same patent family

Date of the actual completion of the international search: 28 July 2015

Date of mailing of the international search report: 05/08/2015

Name and mailing address of the ISA:

European Patent Office, P.O. Box 5818 Patentlaan 2

NL - 2280 HV Rijswijk

Tel. (+31-70) 340-2040; Fax. (+31-70) 340-3016

Authorized officer: Hernandez Marugan, J
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>US 2011/213197 Al (ROBERTSON BRUCE D [US] ET AL) 1 September 2011 (2011-09-01) the whole document</td>
<td>1-34</td>
</tr>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
<td>Patent family member(s)</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-----------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>US 2010010371 A1</td>
<td>14-01-2010</td>
<td>AU 2009268428 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2730404 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NZ 590399 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2010010371 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 2010006273 A1</td>
</tr>
<tr>
<td>WO 9906981 A1</td>
<td>11-02-1999</td>
<td>AU 8769098 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 6012926 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 9906981 A1</td>
</tr>
<tr>
<td>US 6425764 B1</td>
<td>30-07-2002</td>
<td>NONE</td>
</tr>
<tr>
<td>US 2011213197 A1</td>
<td>01-09-2011</td>
<td>NONE</td>
</tr>
</tbody>
</table>