

Claims

1. An electronic arrangement (100) for use (200) in pain management or for treating or ameliorating kinesophobia via virtual reality (VR) or augmented reality (AR), comprising
 - a reproduction equipment (116) comprising a VR and/or AR projection device configured to represent virtual content, comprising an immersive virtual environment or a virtual part of a virtually augmented environment, to the user;
 - user monitoring equipment (114, 114A, 114B) configured to obtain measurement data regarding the user, including motion, location, position, and/or biometric data; and
 - a control system (118, 118A, 118B, 118C), at least functionally connected to the reproduction equipment and the user monitoring equipment, and configured to dynamically determine a personalized therapeutic program including the virtual content for representation via the reproduction equipment, based on the measurement data,wherein the therapeutic program comprises at least two domains of different virtual content, one or more of the domains involving behavior-change content (300, 310, 410, 500) and at least one other domain involving user-activating virtual content (400, 500) indicative of a series of tasks (404, 406, 408) to be conducted by the user having regard to the virtual content through associated therapeutic behavior, such as physical activity, in the physical world outside the virtual environment or virtually augmented environment and tracked by the measurement data;
- wherein the therapeutic program is configured to, based on an indication of the capacity of the user indicated by the measurement data, dynamically determine the personalized therapeutic program so that the therapeutic behavior required to advance the tasks remains within the capacity of the user or exceeds the capacity of the user by a selected amount only;

wherein the therapeutic program is configured to compare first measurement data or data derived therefrom relating to a first body part with second measurement data or data derived therefrom relating to a second body part and/or a reference point, and based on the comparison result to determine an indication of the status, medical condition and/or selected anthropometric, musculoskeletal, physiological or other characteristics of the user;

wherein the first measurement data or data derived therefrom preferably concerns head, trunk or first limb of the user and the second measurement data or data derived therefrom preferably concerns at least second limb of the user;

wherein said first and second measurement data comprises movement data.

2. The arrangement of any preceding claim, comprising an indication of flexibility and/or range of motion to further dynamically determine the personalized therapeutic program.

3. The arrangement of any preceding claim, configured to track the user's behavior, optionally biometric response, relative to the behavior-change content based on the measurement data, wherein the behavior-change content is optionally associated with said or other series of tasks and/or target therapeutic behavior for the user to reach responsive to perceiving the content, and preferably to utilize it in said dynamic determination of the therapeutic program, such as in the adaptation of the behavior-change content.

4. The arrangement of any preceding claim, configured to estimate the performance of the user in conducting the series of tasks by subjecting the measurement data indicative of the behavior of the user to a number of performance evaluation criteria indicative of the therapeutic behavior required to advance the series of the tasks, and based on a resulting estimate of the performance, execute the dynamic determination of the personalized therapeutic program, optionally comprising adapting the virtual content of any of the domains preferably including at least the user-activating domain.

5. The arrangement of any preceding claim, wherein performance evaluation criteria regarding the therapeutic behavior or its implications in the measurement data are stored together with a task definition and/or at least linked therewith.

6. The arrangement of any preceding claim, wherein the performance evaluation criteria include or are supplied to evaluation logic, wherein the measurement data and evaluation values are utilized to determine and output an indication of the performance of the user with a selected resolution.
- 5 7. The arrangement of any preceding claim, configured, based on an indication of the capacity of the user preferably indicated by the measurement data, to notify the user when the capacity limit is approached, reached, or exceeded.
- 10 8. The arrangement of any preceding claim, configured to dynamically determine the personalized therapeutic program based on selecting or configuring such as adapting one or more tasks of the series of tasks and/or the extent of associated therapeutic behavior needed to advance the tasks.
- 15 9. The arrangement of any preceding claim, configured to calculate, based on baseline data, a number of safety ranges used in determining the therapeutic program;

wherein the baseline data includes a user's range of movements tested by the
20 user moving hands/head in all directions as much as comfortably possible.
- 25 10. The arrangement of any preceding claim, wherein a personalized therapeutic objective including a target movement range is determined based on baseline data and/or other status or characteristic information available regarding the user; wherein the status or characteristic information available regarding the user includes one or more of: indication of symptom(s) and/or actual medical condition of the user, and/or height/weight/age/gender type information;

wherein the baseline data includes a user's range of movements tested by the
30 user moving hands/head in all directions as much as comfortably possible.
- 35 11. The arrangement of any preceding claim, configured to represent, visibly and/or audibly, a computer-generated, preferably artificial intelligence based, virtual therapist with a characteristic visual appearance, optionally a graphic figure such as an avatar, and/or voice to the user via the reproduction equipment, and configured to provide the user with instructions, support or feedback, optionally regarding the use of the arrangement or the therapeutic program, via the virtual therapist.

12. The arrangement of any preceding claim, configured to increase the duration of the therapeutic program and lower the estimated difficulty of the included series of tasks from the standpoint of associated therapeutic behavior required to advance the tasks, or vice versa, responsive to control input preferably indicative of a related user-preference.

13. The arrangement of any preceding claim, configured to provide a real-time and/or non-real-time communication channel or platform between the user and at least one other human party, optionally a health care professional and/or other user of the same or a functionally connected other arrangement, preferably in the virtual environment wherein one or more of the communicating parties are represented graphically optionally by avatars; and/or

store and indicate, preferably via the reproduction equipment, the user's performance in meeting an objective preferably comprising conducting the series of tasks, preferably against the user's previous performance and/or the performance of a number of other users.

14. The arrangement of any preceding claim, wherein the dynamic determination comprises at least one element selected from the group consisting of:

- selecting a task from a plurality of tasks;
- configuring the number and/or order of tasks;
- configuring one or more tasks, optionally as to the timing such as duration or pacing, extent, appearance, accuracy, complexity, trajectory, and/or other characteristics of physical motion or other real-life behavior required from the user in the physical world to advance the execution of the tasks regarding the virtual content;
- configuring at least one therapeutic session and/or module comprising virtual content and preferably one or more tasks associated therewith;
- selecting a virtual representation of a task in a virtual or virtually augmented environment from a plurality of options;
- configuring a virtual representation of a task in a virtual or virtually augmented environment;

- selecting a virtual environment from a plurality of virtual environments or a virtual space within the virtual environment from a plurality of spaces;
 - configuring a virtual environment or virtual space within the virtual environment;
 - 5 • configuring one or more virtual objects (302, 304, 306, 312, 314, 316, 318, 404) illustrated in a virtual environment or virtual part of the virtually augmented environment, optionally their type, size, color, rotation, translational movement, position, and/or location, based on the measurement data;
 - configuring behavior-change content and/or mutual order, proportion, transition or other relationship between multiple types of behavior-change content or between behavior-change content and user-activating content; and
 - 10 • configuring user-activating content and/or mutual order, proportion, transition or other relationship between the user-activating content and behavior-change content.
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15. The arrangement of any preceding claim, wherein the virtual content indicative of the series of the tasks to be conducted visualizes one or more virtual target objects (404) reaching, manipulation or other addressing of which in the virtual environment or virtual part of a virtually augmented environment enables to
- 20 achieve the tasks,
- preferably wherein at least one virtual target object (404) defines a preferably geometric shape, optionally a tetromino, polyomino, tetracube, polycube or alike, to be preferably manipulated by rotation, translational movement, introduction, removal, resizing or reshaping in the virtual environment or virtual
- 25 part of the virtually augmented environment, optionally through conducting similar or other activity associated therewith in the physical world by the user and indicated by the measurement data.
- 30 16. The arrangement of any preceding claim, configured to dynamically determine the personalized therapeutic program and/or specifically adapt the virtual content of any domain responsive to time spent by the user in using the arrangement, accessing the virtual content of the therapeutic program or selected domain(s) thereof, or generally participating in the therapeutic program.
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17. The arrangement of any preceding claim, wherein the user monitoring equipment comprises at least one element selected from the group consisting of: personal computer, mobile terminal, wearable electronic device, wristop device,

control input sensor, accelerometer, gyroscope, inertial sensor, camera, optical sensor, location sensor, position sensor, temperature sensor, moisture sensor, pressure sensor, distance sensor, eye sensor, implantable sensor, biometric sensor, motion sensor, and a microphone.

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18. The arrangement of any preceding claim, wherein the control system (118) comprises a first sub-system (118A), optionally being at least partially integral with the reproduction equipment and/or user monitoring equipment, and at least a second sub-system (118B, 118C) remote from but functionally connected, optionally via the internet, to the first sub-system, wherein

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- the first sub-system is configured to process measurement data retrieved from the user monitoring equipment and provide at least portion of the processed data to the second sub-system for further processing, storage and/or determination of at least portion of the therapeutic program or related attributes thereat;

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- the second sub-system is configured to obtain measurement data and/or data derived therefrom from the user monitoring equipment and/or the first sub-system, and to process, store and/or determine at least portion of the therapeutic program or related attributes based on the obtained data; and/or

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- the first sub-system is configured to receive information such as attributes determining the therapeutic program from the second sub-system and to utilize it for controlling the VR reproduction equipment to represent virtual content in accordance with the therapeutic program:

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preferably wherein the first sub-system is configured to autonomously determine the therapeutic program and/or control the reproduction equipment to represent virtual content in accordance with the therapeutic program based on the measurement data, responsive to fulfillment of at least one selected condition such as connection failure between the first and second sub-systems.

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19. The arrangement of any preceding claim, configured to obtain, optionally via the user monitoring equipment (114, 114A) and/or healthcare professional operated control interface (124),

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- user-created subjective data, such as questionnaire, note or diary data, characterizing the status, characteristic and/or condition, such as mental or physical condition, of the user and to utilize the user-created subjective data in dynamically determining the therapeutic program; and/or
 - 5 • healthcare professional-provided subjective data characterizing the status, condition, behavior and/or task related performance of the user, and to utilize the healthcare professional-provided subjective data in dynamically determining the therapeutic program and/or comparing and optionally mutually verifying the healthcare professional-provided data in
10 relation to other data preferably including automatically created sensor-based measurement data or user-created measurement data.
20. The arrangement of any preceding claim, configured to utilize a selected machine learning algorithm in determining the therapeutic program, said machine
15 learning algorithm associating sensor-based objective measurement data and/or subjective data, or data derived therefrom, with the therapeutic program or interim result to be utilized in determining the therapeutic program.
21. The arrangement of any preceding claim, configured to obtain, utilizing said
20 user monitoring equipment, measurement data regarding the user during periods outside the consumption of the virtual content, said obtained measurement data preferably comprising at least one data element selected from the group consisting of: user activity information, call data, messaging data, communication data, physical activity or passivity data, sleep data, insomnia data, social
25 media activity data, motion, motoric, location, position, and/or biometric data.
22. The arrangement of any preceding claim, wherein the virtual content indicative of the series of tasks to be conducted visualizes the nature, progress, goal, outcome and/or execution of the associated therapeutic behavior, such as physical
30 activity, to be performed by the user to advance the execution of one or more of the tasks, optionally utilizing one or more alphanumeric characters, symbols, pictures, or animations.
23. The arrangement of any preceding claim, configured to alternately or simultaneously provide virtual content from at least two domains of virtual content of
35 the therapeutic program, optionally based on the measurement data and/or control input by the user.

24. The arrangement of any preceding claim, wherein the virtual content indicative of the series of the tasks to be conducted comprises audio data.
25. The arrangement of any preceding claim, configured to alter the user's, or of a
5 corresponding virtual character's or pointer's, position, location, rotation or translational speed, and/or viewing direction in a virtual environment or virtually augmented environment based on the measurement data optionally indicative of the user's volitional control input captured through one or more sensors of the user monitoring equipment.
- 10 26. The arrangement of any preceding claim, comprising a haptic device configured to provide haptic sensations to the user preferably at least responsive to contacting a virtual object in the virtual or augmented environment.
- 15 27. A method comprising:
at an electronic arrangement (100) including
-a reproduction equipment (116) comprising a VR and/or AR projection device configured to represent virtual content, comprising an immersive virtual environment or a virtual part of a virtually augmented environment, to the user;
20 -user monitoring equipment (114, 114A, 114B) configured to obtain measurement data regarding the user, including motion, location, position, and/or biometric data; and
25 -a control system (118, 118A, 118B, 118C), at least functionally connected to the reproduction equipment and the user monitoring equipment, and configured to dynamically determine a personalized therapeutic program including the virtual content for representation via the reproduction equipment, based on the measurement data,
30 presenting two domains of different virtual content, one or more of the domains involving behavior-change content (300, 310, 410, 500) and at least one other domain involving user-activating virtual content (400, 500) indicative of a series of tasks (404, 406, 408) to be conducted by the user having
35 regard to the virtual content through associated therapeutic behavior, such as physical activity, in the physical world outside the virtual environment or virtually augmented environment and tracked by the measurement data;

based on an indication of the capacity of the user indicated by the measurement data, dynamically determining the personalized therapeutic program so that the therapeutic behavior required to advance the tasks remains within the capacity of the user or exceeds the capacity of the user by a selected amount only;

comparing first measurement data or data derived therefrom relating to a first body part with second measurement data or data derived therefrom relating to a second body part and/or a reference point, and based on the comparison result determining an indication of the status, medical condition and/or selected anthropometric, musculoskeletal, physiological or other characteristics of the user;

wherein the first measurement data or data derived therefrom preferably concerns head, trunk or first limb of the user and the second measurement data or data derived therefrom preferably concerns at least second limb of the user; and

wherein said first and second measurement data comprises movement data.

28. The method of any preceding claim, comprising determining an indication of flexibility and/or range of motion to further dynamically determine the personalized therapeutic program.

29. The method of any preceding claim, comprising:
tracking the user's behavior, optionally biometric response, relative to the behavior-change content based on the measurement data,
wherein the behavior-change content is optionally associated with said or other series of tasks and/or target therapeutic behavior for the user to reach responsive to perceiving the content, and preferably to utilize it in said dynamic determination of the therapeutic program, such as in the adaptation of the behavior-change content.

30. The method of any preceding claim, comprising:
estimating the performance of the user in conducting the series of tasks by subjecting the measurement data indicative of the behavior of the user to a number of performance evaluation criteria indicative of the therapeutic behavior required to advance the series of the tasks, and

based on a resulting estimate of the performance, executing the dynamic determination of the personalized therapeutic program, optionally comprising adapting the virtual content of any of the domains preferably including at least the user-activating domain.

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31. The method of any preceding claim, wherein performance evaluation criteria regarding the therapeutic behavior or its implications in the measurement data are stored together with a task definition and/or at least linked therewith.

10 32. The method of any preceding claim, wherein the performance evaluation criteria include or are supplied to evaluation logic, wherein the measurement data and evaluation values are utilized to determine and output an indication of the performance of the user with a selected resolution.

15 33. The method of any preceding claim, comprising:
based on an indication of the capacity of the user preferably indicated by the measurement data, notifying the user when the capacity limit is approached, reached, or exceeded.

20 34. The method of any preceding claim, comprising:
dynamically determining the personalized therapeutic program based on selecting or configuring such as adapting one or more tasks of the series of tasks and/or the extent of associated therapeutic behavior needed to advance the tasks.

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35. The method of any preceding claim, comprising calculating, based on baseline data, a number of safety ranges used in determining the therapeutic program; wherein the baseline data includes a user's range of movements tested by the user moving hands/head in all directions as much as comfortably possible.

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36. The method of any preceding claim, comprising determining a personalized therapeutic objective including a target movement range based on baseline data and/or other status or characteristic information available regarding the user; wherein the status or characteristic information available regarding the user includes one or more of: indication of symptom(s) and/or actual medical condition of the user, and/or height/weight/age/gender type information; wherein the baseline data includes a user's range of movements tested by the user moving hands/head in all directions as much as comfortably possible.

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37. The method of any preceding claim, comprising representing, visibly and/or audibly, a computer-generated, preferably artificial intelligence based, virtual therapist with a characteristic visual appearance, optionally a graphic figure such as an avatar, and/or voice to the user via the reproduction equipment, and providing the user with instructions, support or feedback, optionally regarding the use of the arrangement or the therapeutic program, via the virtual therapist.
38. The method of any preceding claim, comprising increasing the duration of the therapeutic program and lowering the estimated difficulty of the included series of tasks from the standpoint of associated therapeutic behavior required to advance the tasks, or vice versa, responsive to control input preferably indicative of a related user-preference.
39. The method of any preceding claim, comprising:
providing a real-time and/or non-real-time communication channel or platform between the user and at least one other human party, optionally a health care professional and/or other user of the same or a functionally connected other arrangement, preferably in the virtual environment wherein one or more of the communicating parties are represented graphically optionally by avatars; and/or
storing and indicating, preferably via the reproduction equipment, the user's performance in meeting an objective preferably comprising conducting the series of tasks, preferably against the user's previous performance and/or the performance of a number of other users.
40. The method of any preceding claim, wherein the dynamic determination comprises at least one element selected from the group consisting of:
- selecting a task from a plurality of tasks;
 - configuring the number and/or order of tasks;
 - configuring one or more tasks, optionally as to the timing such as duration or pacing, extent, appearance, accuracy, complexity, trajectory, and/or other characteristics of physical motion or other real-life behavior required from the user in the physical world to advance the execution of the tasks regarding the virtual content;
 - configuring at least one therapeutic session and/or module comprising virtual content and preferably one or more tasks associated therewith;

- selecting a virtual representation of a task in a virtual or virtually augmented environment from a plurality of options;
 - configuring a virtual representation of a task in a virtual or virtually augmented environment;
 - 5 • selecting a virtual environment from a plurality of virtual environments or a virtual space within the virtual environment from a plurality of spaces;
 - configuring a virtual environment or virtual space within the virtual environment;
 - 10 • configuring one or more virtual objects (302, 304, 306, 312, 314, 316, 318, 404) illustrated in a virtual environment or virtual part of the virtually augmented environment, optionally their type, size, color, rotation, translational movement, position, and/or location, based on the measurement data;
 - configuring behavior-change content and/or mutual order, proportion, transition or other relationship between multiple types of behavior-change content or between behavior-change content and user-activating content; and
 - 15 • configuring user-activating content and/or mutual order, proportion, transition or other relationship between the user-activating content and behavior-change content.
- 20 41. The method of any preceding claim, wherein the virtual content indicative of the series of the tasks to be conducted visualizes one or more virtual target objects (404) reaching, manipulation or other addressing of which in the virtual environment or virtual part of a virtually augmented environment enables to achieve the tasks,
- 25 preferably wherein at least one virtual target object (404) defines a preferably geometric shape, optionally a tetromino, polyomino, tetracube, polycube or alike, to be preferably manipulated by rotation, translational movement, introduction, removal, resizing or reshaping in the virtual environment or virtual
- 30 part of the virtually augmented environment, optionally through conducting similar or other activity associated therewith in the physical world by the user and indicated by the measurement data.
- 35 42. The method of any preceding claim, comprising dynamically determining the personalized therapeutic program and/or specifically adapt the virtual content of any domain responsive to time spent by the user in using the arrangement, accessing the virtual content of the therapeutic program or selected domain(s) thereof, or generally participating in the therapeutic program.

43. The method of any preceding claim, wherein the user monitoring equipment comprises at least one element selected from the group consisting of: personal computer, mobile terminal, wearable electronic device, wrist device, control
5 input sensor, accelerometer, gyroscope, inertial sensor, camera, optical sensor, location sensor, position sensor, temperature sensor, moisture sensor, pressure sensor, distance sensor, eye sensor, implantable sensor, biometric sensor, motion sensor, and a microphone.
- 10 44. The method of any preceding claim, wherein the control system (118) comprises a first sub-system (118A), optionally being at least partially integral with the reproduction equipment and/or user monitoring equipment, and at least a second sub-system (118B, 118C) remote from but functionally connected, optionally via the internet, to the first sub-system, wherein
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- the first sub-system is configured to process measurement data retrieved from the user monitoring equipment and provide at least portion of the processed data to the second sub-system for further processing, storage and/or determination of at least portion of the therapeutic program or related attributes thereat;
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 - the second sub-system is configured to obtain measurement data and/or data derived therefrom from the user monitoring equipment and/or the first sub-system, and to process, store and/or determine at least portion
25 of the therapeutic program or related attributes based on the obtained data; and/or
 - the first sub-system is configured to receive information such as attributes determining the therapeutic program from the second sub-system and to utilize it for controlling the VR reproduction equipment to represent virtual content in accordance with the therapeutic program:
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- preferably wherein the first sub-system is configured to autonomously determine the therapeutic program and/or control the reproduction equipment to represent virtual content in accordance with the therapeutic program based on the
35 measurement data, responsive to fulfillment of at least one selected condition such as connection failure between the first and second sub-systems.

45. The method of any preceding claim, comprising obtaining, optionally via the user monitoring equipment (114, 114A) and/or healthcare professional operated control interface (124),
- 5 • user-created subjective data, such as questionnaire, note or diary data, characterizing the status, characteristic and/or condition, such as mental or physical condition, of the user and to utilize the user-created subjective data in dynamically determining the therapeutic program; and/or
 - 10 • healthcare professional-provided subjective data characterizing the status, condition, behavior and/or task related performance of the user, and to utilize the healthcare professional-provided subjective data in dynamically determining the therapeutic program and/or comparing and optionally mutually verifying the healthcare professional-provided data in relation to other data preferably including automatically created sensor-based measurement data or user-created measurement data.
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46. The method of any preceding claim, comprising utilizing a selected machine learning algorithm in determining the therapeutic program, said machine learning algorithm associating sensor-based objective measurement data and/or subjective data, or data derived therefrom, with the therapeutic program or interim result to be utilized in determining the therapeutic program.
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47. The method of any preceding claim, comprising utilizing said user monitoring equipment, measurement data regarding the user during periods outside the consumption of the virtual content, said obtained measurement data preferably comprising at least one data element selected from the group consisting of: user activity information, call data, messaging data, communication data, physical activity or passivity data, sleep data, insomnia data, social media activity data, motion, motoric, location, position, and/or biometric data.
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48. The method of any preceding claim, wherein the virtual content indicative of the series of tasks to be conducted visualizes the nature, progress, goal, outcome and/or execution of the associated therapeutic behavior, such as physical activity, to be performed by the user to advance the execution of one or more of the tasks, optionally utilizing one or more alphanumeric characters, symbols, pictures, or animations.
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49. The method of any preceding claim, comprising alternately or simultaneously providing virtual content from at least two domains of virtual content of the therapeutic program, optionally based on the measurement data and/or control input by the user.
50. The method of any preceding claim, wherein the virtual content indicative of the series of the tasks to be conducted comprises audio data.
51. The method of any preceding claim, comprising altering the user's, or of a corresponding virtual character's or pointer's, position, location, rotation or translational speed, and/or viewing direction in a virtual environment or virtually augmented environment based on the measurement data optionally indicative of the user's volitional control input captured through one or more sensors of the user monitoring equipment.
52. The method of any preceding claim, comprising a haptic device and providing haptic sensations to the user preferably at least responsive to contacting a virtual object in the virtual or augmented environment.
53. A computer program product optionally embodied in a preferably non-transitory computer-readable carrier medium, said program comprising instructions, which, when the program is executed by a computer, cause the computer to perform the method of any of the preceding method claims.
54. A method (700) for pain management or for treating or ameliorating kinesophobia using the electronic arrangement (100) according to any of claims 1 to 26 for the application of virtual reality (VR) or augmented reality (AR), said method comprising:
- providing virtual content (706) comprising immersive virtual environment or a virtual part of a virtually augmented environment to the user via reproduction equipment comprising a VR and/or AR projection device;
- obtaining (702, 710) measurement data, via the user monitoring equipment (114, 114A, 114B) of said electronic arrangement, regarding motion and/or position of the user; and

dynamically determining (708) a personalized therapeutic program including the virtual content for representation via the reproduction equipment, based on the measurement data,

5 wherein the therapeutic program comprises at least two domains of different virtual content including

- (i) one or more of the domains involving behavior-change content; and
 - (ii) at least one other domain involving user-activating virtual content indicative of a series of tasks to be conducted by the user having regard to the virtual content through associated therapeutic behavior, such as physical or problem solving activity, in the physical world outside the virtual environment or virtually augmented environment and tracked by the measurement data.
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15 55. The method of claim 54, further obtaining biometric data of the user.

56. The method of claim 54 or 55, wherein the subject is suffering from chronic or long lasting pain, such as chronic or long lasting lower back pain.

20 57. The method according to any one of claims 54 to 56 wherein the subject is suffering from pain associated anxiety or avoidance of movement in open spaces or avoidance of movement in crowded areas.

25 58. The method according to any one of claims 54 to 57, wherein the measurement data relation to user motion is selected from acceleration, velocity, motion of a specific body part.

59. The method according to any one of claims 54 to 58, wherein the therapeutic program is dynamically adapted to the user performance.

30 60. The method according to any one of claims 54 to 59, wherein the therapeutic program is dynamically adapted to the user performance by comparing and evaluating the result of one or more completed tasks.

35 61. A computer program product optionally embodied in a preferably non-transitory computer-readable carrier medium, said program comprising instructions, which, when the program is executed by a computer, cause the computer to carry out an embodiment of a method of any one of claims 54 to 60.