CLAIMS

What is claimed is :

1. An autodidactic method for personalized memory training comprising :

obtaining real-time neural sensor data of a subject during a memory exercise comprising electroencephalography (EEG) signals obtained from the subject by one or more EEG electrodes attached to the subject during the memory exercise;

obtaining real-time physiological and behavioural sensor data of a subject during a memory exercise comprising real-time visual information of the subject during the memory exercise obtained from at least one visual recording device, the real-time neural sensor data and the real-time physiological sensor data comprising real-time neuro-physiological data;

determining throughout the memory exercise whether the real-time neuro-physiological sensor data includes predetermined information indicative of cognitive functions used for remembering, wherein a subject's cognitive functions used for remembering comprise immediate memory, visuospatial memory, attention memory and delayed memory, and wherein the memory exercise is configured to assess in real-time at least two of the subject's cognitive functions used for remembering as the subject performs the memory exercise;

advancing the memory exercise when it is determined that the real-time neuro-physiological sensor data includes the predetermined information indicative of the cognitive functions used for remembering;

calculating an objective cognitive assessment of the subject in response to completion of the memory exercise, the objective cognitive assessment of the subject assessing the subject's performance of the cognitive functions used for remembering as such performance varies throughout the memory exercise and calculated at least partially in response to the advancing the memory exercise; and

revising the memory exercise to test for an adjusted set of the subject's cognitive functions used for remembering in response to the calculated objective cognitive assessment of the subject.

2. The method according to claim 1, wherein the memory exercise will not advance when it is determined that the real-time neuro-physiological sensor data does not include the predetermined information indicative of the cognitive functions used for remembering.

3. The method according to any one of the preceding claims, wherein determining whether the real-time neuro-physiological sensor data includes the predetermined information indicative of the cognitive functions used for remembering comprises determining the real-time neuro-physiological sensor data includes the predetermined information indicative of the cognitive functions used for remembering in response to one or more of a predetermined portion of the memory exercise is completed in a predetermined time duration, complexity of the memory exercise, difficulty of the memory exercise, accuracy of the subject and condition of the subject.

4. The method according to any one of the preceding claims, further comprising determining whether a score is achieved for a current level of the memory exercise before the advancing step, the score being indicative of a time taken to complete the memory exercise.

5. The method according to any one of the preceding claims, wherein the memory exercise comprises matching of pictures and/or words and determining the real-time neuro-physiological sensor data includes the predetermined information indicative of the cognitive functions used for remembering comprises determining the real-time neuro-physiological sensor data obtained during the memory exercise includes predetermined information indicative of at least visuospatial memory and immediate memory.

6. The method according to any one of the preceding claims, wherein the step of determining whether the sensor data includes the predetermined information indicative of the cognitive functions used for remembering comprises passing the real-time neuro-physiological sensor data through a filter to determine whether the real-time neuro-physiological sensor data includes the predetermined information indicative of the cognitive functions used for remembering.

7. The method according to any one of the preceding claims, wherein the visual information of the subject during the memory exercise obtained from at least one visual recording device comprises visual information obtained from a video camera during the memory exercise.

8. An autodidactic personalized memory training device comprising:

at least a first input device and a second input device for receiving real-time neuro-physiological sensor data of a subject during a memory exercise, wherein the first input device comprises one or more electroencephalography (EEG) electrodes attached to the subject during

the memory exercise for obtaining real-time EEG signals comprising real-time neural sensor data, and wherein the second input device comprises at least one visual recording device for obtaining real-time visual information of the subject during the memory exercise comprising real-time physiological sensor data, and wherein the real-time neuro-physiological sensor data comprises the real-time neural sensor data and the real-time physiological sensor data;

a cognitive function evaluator adapted to receive the real-time neuro-physiological sensor data from the at least one input device and determine whether the real-time neuro-physiological sensor data includes predetermined information indicative of cognitive functions used for remembering, wherein a subject's cognitive functions used for remembering comprise immediate memory, visuospatial memory, attention memory and delayed memory, and wherein the memory exercise is configured to assess in real-time at least two of the subject's cognitive functions used for remembering as the subject performs the memory exercise; ~~and~~

an exercise device adapted to advance the memory exercise when it is determined that the real-time neuro-physiological sensor data includes the predetermined information indicative of the cognitive functions used for remembering, the exercise device comprising a calculating device adapted to calculate an objective cognitive assessment of the subject in response to completion of the memory exercise, the objective cognitive assessment of the subject assessing the subject's performance of the cognitive functions used for remembering as such performance varies throughout the memory exercise, wherein the calculating device is further adapted to calculate the objective cognitive assessment of the subject at least partially in response to the advancing of the memory exercise;

a cognitive assessor coupled to the exercise device and operable to receive and assess the calculated objective cognitive assessment of the subject;

an optimizer coupled to the cognitive assessor and adapted to store information, the information comprising the real-time neuro-physiological sensor data and the memory exercise; and

a configurator coupled to the optimizer, the configurator adapted to configure the memory exercise in response to the received assessed objective cognitive assessment of the subject, the configurator revising the memory exercise to test for an adjusted set of the subject's cognitive functions used for remembering in response to the calculated objective cognitive assessment of the subject,

wherein the cognitive assessor is adapted to transmit the assessed objective cognitive assessment of the subject to the optimizer.

9. The autodidactic personalized memory training device according to claim 8, wherein the exercise device is adapted not to advance the memory exercise when it is determined that the real-time neuro-physiological sensor data does not include the predetermined information indicative of the cognitive functions used for remembering.

10. The autodidactic personalized memory training device according to either of claims 8 or 9, wherein the cognitive function evaluator is further adapted to determine the real-time neuro-physiological sensor data includes the predetermined information indicative of the cognitive functions used for remembering in response to one or more of a predetermined portion of the memory exercise is completed in a predetermined time duration, complexity of the memory exercise, difficulty of the memory exercise, accuracy of the subject and condition of the subject.

11. The autodidactic personalized memory training device according to any of claims 8 to 10, wherein the exercise device is further adapted to determine whether a score is achieved for a current level of the memory exercise and advance the memory exercise when it is determined the score is achieved for the current level of the memory exercise.

12. The autodidactic personalized memory training device according to any of claims 8 to 11, wherein the at least one visual recording device comprises a video camera.

13. The autodidactic personalized memory training device according to any of claims 8 to 12, wherein the at least one input device is coupled to a sensor signal translator, the sensor signal translator operable to translate the real-time neuro-physiological sensor data received from the at least one input device, and wherein the cognitive function evaluator is coupled to the sensor signal translator and operable to receive the translated real-time neuro-physiological sensor data and determine whether the translated real-time neuro-physiological sensor data includes the predetermined information indicative of the cognitive functions used for remembering.

14. The autodidactic personalized memory training device according to any of claims 8 to 13 wherein the optimizer is further adapted to store information comprising a subject profile corresponding to the subject and update the subject profile of the subject in response to each of the received objective cognitive assessment of the subject received from the cognitive assessor.

15. The autodidactic personalized memory training device according to claim 14, wherein the configurator is adapted to configure the memory exercise in response to both the received assessed objective cognitive assessment of the subject and the subject profile.

16. The autodidactic personalized memory training device according to claim 15, wherein the configurator is further adapted to adjust the predetermined information indicative of cognitive functions used for remembering corresponding to the subject in response to the updated subject profile.

17. The autodidactic personalized memory training device according any of claims 8 to 16, wherein the memory exercise comprises matching of pictures and/or words, and wherein the exercise device is further adapted to determine whether the real-time neuro-physiological sensor data received during the memory exercise includes predetermined information indicative of at least visuospatial memory and immediate memory.

18. The autodidactic personalized memory training device according to any of claims 8 to 17, wherein the cognitive function evaluator comprises a filter, and wherein the cognitive function evaluator is further adapted to pass the real-time neuro-physiological sensor data through the filter so as to determine whether the real-time neuro-physiological sensor data includes the predetermined information indicative of the cognitive functions used for remembering.

19. The autodidactic personalized memory training device according to any of claims 8 to 18, wherein the exercise device is further adapted to advance the memory exercise in accordance with machine learning techniques.

20. The autodidactic personalized memory training device according to any of claims 8 to 19, wherein the calculating device is further adapted to calculate the objective cognitive assessment of the subject in accordance with probabilistic modeling.

21. The autodidactic personalized memory training device according to any of claims 8 to 20, wherein the calculating device is further adapted to calculate the objective cognitive assessment of the subject in response to time taken to complete the memory exercise.

22. A system comprising :

an autodidactic personalized memory training device as claimed in any of claims 14 to 21; and

a server coupled to the autodidactic personalized memory training device and comprising a receiver operable to receive the objective cognitive assessment of the subject from the autodidactic personalized memory training device.

23. The system according to claim 22, wherein the server is operable to receive and store the subject profile.

24. The system according to either claim 22 or claim 23 comprising two or more autodidactic personalized memory training devices as claimed in any of claims 14 to 21, wherein the receiver is further operable to receive the objective cognitive assessment of two or more subjects corresponding to the two or more autodidactic personalized memory training devices, and wherein the server is further operable to correlate the two or more subjects with their respective objective cognitive assessments.

25. A computer readable medium for autodidactic personalized memory training, the computer readable medium having stored thereon computer program code which when executed by a computer causes the computer to perform at least the following:

determining whether real-time neuro-physiological sensor data obtained from a subject throughout a memory exercise includes predetermined information indicative of cognitive functions used for remembering, wherein a subject’s cognitive functions used for remembering comprises immediate memory, visuospatial memory, attention memory and delayed memory, and wherein the memory exercise is configured to assess in real-time at least two of the subject’s cognitive functions used for remembering as the subject performs the memory exercise, the real-time neurophysiological sensor data including at least real-time neural sensor data obtained from the subject during the memory exercise by one or more

electroencephalography (EEG) electrodes attached to the subject during the memory exercise and real-time physiological sensor data including at least real-time visual information of the subject during the memory exercise obtained from at least one visual recording device;

advancing the memory exercise when it is determined that the real-time neuro-physiological sensor data includes predetermined information indicative of the cognitive functions used for remembering;

calculating an objective cognitive assessment of the subject in response to completion of the memory exercise; and

revising the memory exercise to test for an adjusted set of the subject's cognitive functions used for remembering in response to the calculated objective cognitive assessment of the subject,

wherein the objective cognitive assessment of the subject assesses the subject's performance of the cognitive functions used for remembering as such performance varies throughout the memory exercise, and

wherein the objective cognitive assessment of the subject is also calculated at least partially in response to the advancing the memory exercise.