CLAIMS

1. A system for enhancing learning of an activity, comprising:

a housing configured to fit in or on at least a portion of an ear of a subject;

a neural stimulator located in or on the housing and configured to deliver a transcutaneous neural stimulus to a peripheral neural structure located at least in part in or on the ear of the subject;

a prompting system configured to deliver at least one prompt for prompting the subject to repeatedly perform a specific activity; and

electrical control circuitry including

stimulator control circuitry adapted to generate at least one stimulus control signal for controlling delivery of the transcutaneous neural stimulus to the peripheral neural structure with the neural stimulator, wherein the transcutaneous neural stimulus is a memory-blocking stimulus;

prompter control circuitry adapted to generate at least one prompt control signal for controlling delivery of the prompt by the prompting system; and

timing control circuitry for controlling a number of repetitions of the specific activity that the subject is prompted to perform by the at least one prompt and timing of delivery of the transcutaneous neural stimulus with respect to the at least one prompt.

2. The system of claim 1, including a sensing system for detecting performance of the activity by the subject.

3. The system of claim 2, wherein the sensing system includes at least one of an EEG sensor, and EMG sensor, an oxygenation sensor, a motion sensor, a pressure sensor, a force sensor, an accelerometer, an inclinometer, an implantable sensor, a wearable sensor, a sensor carried by the subject, a sensor in or on an instrument, implement, or article of equipment carried by the subject, a remote camera, and a microphone.

4. The system of claim 1, wherein the prompting system is located at least in part in or on the housing; wherein the prompting system is configured as a wearable item; or wherein the prompting system is configured for attachment to or mounting in or on an instrument, implement, article of equipment, or article of clothing.

5. A computer program product, comprising:

at least one non-transitory computer-readable medium bearing:

one or more instructions for delivering, with a neural stimulator housed in a housing configured to be fitted in or on at least a portion of an ear of a subject, a transcutaneous neural stimulus to a peripheral neural structure configured to be located at least in part in or on the ear of a subject, wherein the neural stimulator is controlled by electrical control circuitry operably coupled to the neural stimulator;

one or more instructions for delivering, with a prompting system under control of the electrical control circuitry, a plurality of prompts for prompting a subject to repeatedly perform a specific activity, wherein the electrical control circuitry is operably coupled to the prompting system;

one or more instructions for controlling, with the electrical control circuitry

a timing of delivery of the transcutaneous neural stimulus with respect to the plurality of prompts; and

a plurality of repetitions of the specific activity that the subject is prompted to perform by at least one of:

controlling delivery of one prompt for each of the plurality of repetitions;

controlling delivery of a first prompt that informs of the plurality of repetitions and a second prompt that is repeated once for each of the plurality of repetitions;

controlling delivery of a first prompt that informs of the specific activity that is to be performed and a second prompt that is repeated once for each of the plurality of repetitions; or

controlling delivery of the at least one prompt at a fixed rate for a fixed period of time.

6. The computer program product of claim 5, including one or more instructions for detecting performance of the activity by the subject with a sensing system.

7. The computer program product of claim 5, including one or more instructions for delivering a secondary stimulus to the subject with a secondary stimulus source.

8. The computer program product of claim 5, including

one or more instructions for tracking, with a tracking module, practice session data relating to at least one practice session during which the subject practices the activity; and

one or more instructions for storing the tracked practice session data in a data storage location.

9. The computer program product of claim 5, wherein delivering the plurality of prompts includes at least one of delivering the plurality of prompts via a personal computing

device; delivering the plurality of prompts via a wearable item; delivering the plurality of prompts via a prompting system attached to or mounted in or on an instrument, implement, article of equipment, or article of clothing; or delivering the plurality of prompts via two or more of a display, a light, a speaker, a vibrator, an electrical stimulator, and an olfactory stimulus source.

10. The computer program product of claim 5, wherein the transcutaneous neural stimulus is a learning-enhancing stimulus or a memory-blocking stimulus.

11. The computer program product of claim 5, including one or more instructions for delivering the transcutaneous neural stimulus to at least one of a cranial nerve of the subject, a vagal nerve of the subject, a trigeminal nerve of the subject, a glossopharyngeal nerve of the subject, a peripheral neural structure innervating a pinna of the ear of the subject, a peripheral neural structure innervating an ear canal of the ear of the subject, or a peripheral neural structure innervating a concha of the ear of the subject.

12. The computer program product of claim 5, including one or more instructions for at least one of receiving, with an interface device, a control input for setting stimulation parameters; sending a communication from the electrical control circuitry to a computing or communication network via communication circuitry operably coupled to the electrical control circuitry; receiving a communication at the electrical control circuitry from the computing or communication network via communication circuitry operably coupled to the electrical control circuitry; providing an output to the subject via a user interface device; and receiving an input from the subject via a user interface device.

13. The computer program product of claim 5, including

one or more instructions for creating a practice session schedule;

one or more instructions for storing the practice session schedule in a data storage location operatively coupled to the electrical control circuitry; and

one or more instructions for generating reminders for delivery to the subject via at least one user interface device operably coupled to the control circuitry to remind the subject of one or more practice sessions from the practice session schedule stored in the data storage location.

14. A computer program product, comprising:

at least one non-transitory computer-readable medium bearing

one or more instructions for generating, under control of electrical control circuitry, a least one stimulus control signal for controlling delivery of a transcutaneous neural stimulus to a peripheral neural structure located at least in part in or on an ear of a subject via a neural stimulator fitted in or on at least a portion of the ear of a subject;

one or more instructions for delivering, via a prompting system under control of the electrical control circuitry, at least one prompt for prompting the subject to repeatedly perform a specific activity;

one or more instructions for controlling a timing of delivery of the transcutaneous neural stimulus with respect to the at least one prompt, wherein the transcutaneous neural stimulus is a memory-blocking stimulus; and

one or more instructions for controlling a number of repetitions of the specific activity that the subject is prompted to perform by the at least one prompt.

15. The computer program product of claim 14 wherein the at least one non-transitory computer-readable medium bears at least one of one or more instructions for receiving, with an interface device, a control input for setting stimulation parameters; one or more instructions for sending a communication from the electrical control circuitry to a computing or communication network, via communication circuitry operably coupled to the electrical control circuitry; one or more instructions for receiving a communication at the electrical control circuitry from a computing or communication network, via communication circuitry operably coupled to the electrical control circuitry; or one or more instructions for providing an output to the subject or receiving an input from the subject via a user interface device.

16. The computer program product of claim 14, wherein the at least one non-transitory computer-readable medium bears

one or more instructions for creating a practice session schedule;

one or more instructions storing the practice session schedule in a data storage location operatively coupled to the electrical control circuitry; and

one or more instructions for generating reminders for delivery to the subject via at least one user interface device operably coupled to the control circuitry to remind the subject of one or more practice sessions from the practice session schedule stored in the data storage location.

17. The computer program product of claim 14, wherein the at least one non-transitory computer-readable medium bears

one or more instructions for tracking, with a tracking module, practice session data relating to at least one practice session during which the subject practices the activity; and

one or more instructions for storing the tracked practice session data in a data storage location.

18. The computer program product of claim 17, wherein the one or more instructions for storing the tracked practice session data in the data storage location include one or more instructions for storing at least one of a time, a date, or a duration of at least one practice session; wherein the at least one non-transitory computer-readable medium bears one or more instructions for generating practice session trends or metrics based on one or more tracked practice sessions; or wherein the at least one non-transitory computer-readable medium bears one or more instructions for transferring, with a reward module, a reward to the subject account based upon the tracked practice session data.

19. The computer program product claim 17, wherein the at least one non-transitory computer-readable medium bears one or more instructions for reporting, with reporting circuitry, information regarding one or more tracked practice sessions, practice session trends, or practice session metrics to one or more of the subject, a parent, an instructor, a coach, a medical care provider, a peer, or a computing system.

20. The computer program product of claim 19, wherein the one or more instructions for reporting with the reporting circuitry include one or more instructions for providing reports based on the tracked practice session data to a scoring module; wherein the at least one non-transitory computer-readable medium bears one or more instructions for assigning, with the scoring module, a score or ranking to the subject based on the performance of the subject during the one or more tracked practice sessions; or wherein the at least one non-transitory computer-readable medium bears one or more instructions for assigning, with the scoring module, a score or ranking to the subject based on the subject's performance relative to the performance of one or more other individuals.

21. A system for enhancing learning, comprising:

a noninvasive device for stimulating a cranial nerve of a subject, the device including at least one transcutaneous neural stimulator;

at least one neural sensor adapted to sense at least one neural activity of the subject;

a prompting system configured to deliver a plurality of prompts for prompting the subject to repeatedly perform a specific activity; and

electrical control circuitry including

stimulator control circuitry adapted to generate at least one stimulus control signal for controlling delivery of a transcutaneous neural stimulus to the cranial nerve with the transcutaneous neural stimulator;

prompter control circuitry adapted to generate at least one prompt control signal for controlling delivery of the plurality of prompts by the prompting system; and

timing control circuitry for controlling a plurality of repetitions of the specific activity that the subject is prompted to perform by the plurality of prompts and timing of delivery of the transcutaneous neural stimulus with respect to the at least one prompt;

wherein the plurality of prompts include at least one of:

one prompt for each of the plurality of repetitions;

a first prompt that informs the subject of the plurality of repetitions and a second prompt that is repeated once for each of the plurality of repetitions;

a first prompt that informs the subject of the specific activity that is to be performed and a second prompt that is repeated once for each of the plurality of repetitions; or

controlling delivery of the at least one prompt at a fixed rate for a fixed period of time.

22. The system of claim 21, wherein the transcutaneous neural stimulator includes at least one of an earbud, a TENS unit, or a patch electrode.

23. A training system, comprising:

an audio signal source adapted to generate an audio signal for driving production by a sound source of a sound output for delivery to the ear of the subject, the sound output corresponding to a sound pattern and for prompting the subject to repeatedly perform a specific activity;

at least one earpiece adapted to be carried by the ear of a subject;

at least one cranial nerve stimulator associated with at least one said earpiece, the at least one cranial nerve stimulator adapted to deliver a learning enhancing stimulus to a cranial nerve of the subject in association with the sound pattern, the learning enhancing stimulus adapted to enhance learning corresponding to the sound pattern by the subject;

a stimulator driver operatively connected to the at least one cranial nerve stimulator and configured to generate a stimulus control signal adapted to drive delivery of the learning enhancing stimulus by the at least one cranial nerve stimulator; and

a controller operatively connected to the audio signal source and the stimulator driver and configured to control at least one of generation of the audio signal by the audio signal source and generation of the stimulus control signal by the stimulator driver.

24. The system of claim 23, further comprising

a display adapted to provide to the subject a visual prompt corresponding to the sound pattern and

a display controller configured to control presentation of the visual prompt via the display.

25. The system of claim 23, further comprising at least one attention sensor operatively connected to the controller for sensing at least one parameter indicative of attentiveness of the subject.

26. The system of claim 23, wherein the at least one cranial nerve stimulator includes at least one of a mechanical stimulator, an electrical stimulator, a magnetic stimulator, an electromagnetic stimulator, a thermal stimulator, an acoustic stimulator, and an ultrasonic stimulator.

27. The system of claim 23, further comprising at least one of a notification system adapted to deliver a notification to at least one of the subject and at least one additional party; a notification system adapted to generate at least one of audio alarm tone, a verbal notification, a visible notification, a tactile notification, or an electronic notification stored in a data storage location or an electronic notification transmitted to at least one additional location; communication circuitry operably coupled to the controller and adapted to provide communication between the controller and a computing or communication network; or a reporting circuitry adapted to provide a report to one or more of the subject, a parent, an instructor, a coach, a medical care provider, a peer, a computing system.

28. The system of claim 23, further comprising at least one sound sensor operatively connected to the controller and adapted to sense a sound pattern produced by the subject.

29. A computer program product, comprising:

at least one non-transitory computer-readable medium bearing

one or more instructions for generating, with an audio signal source under control of a controller, an audio signal for driving production of a sound output by an sound source in an earpiece carried by an ear of a subject, the sound output corresponding to a sound pattern, wherein a task to be learned by the subject corresponds to the sound pattern;

one or more instructions for generating, with a stimulator driver under control of the controller, a neural stimulus control signal adapted to drive delivery of a neural stimulus with at least one transcutaneous nerve stimulator associated with the at least one earpiece and positioned on the ear of the subject to stimulate a cranial nerve of the subject, the neural stimulus adapted to enhance learning of the task by the subject; and

one or more instructions for coordinating, with the controller, timing of delivery of the neural stimulus responsive to the stimulus control signal with respect to timing of delivery of the sound output.

30. A learning system for enhancing learning of a sound pattern by a subject, comprising:

a neural stimulator for delivering a neural stimulus adapted to enhance learning of a sound pattern by a subject;

a stimulator driver adapted to drive delivery of the neural stimulus by the neural stimulator;

a sound source adapted to provide a sound output to the subject;

a personal computing device including

a processor;

an audio signal source adapted to drive delivery of the sound output by the sound source;

a display;

an example module for controlling delivery of an example of the sound pattern to the subject via at least one of the sound source and the display;

a prompting module for driving delivery of a prompt via at least one of the sound source or the display, in association with delivery of the neural stimulus by the neural stimulator.

31. A computer program product, comprising:

one or more instructions for providing an example of the sound pattern to a subject with a first output device under control of controller;

one or more instructions for delivering a prompt, via a second output device controlled by the controller, for prompting to mentally rehearse the sound pattern; and

one or more instructions for delivering a neural stimulus to the subject in association with the prompt, wherein the neural stimulus is delivered with a neural stimulator controlled by the controller and is adapted to enhance learning of the sound pattern-by the subject.

32. A computer program product, comprising:

at least one non-transitory computer-readable medium bearing

one or more instructions for providing an example of the sound pattern to the subject with a first output device under control of controller;

one or more instructions for delivering a prompt, via a second output device controlled by the controller, for prompting the subject to mentally rehearse the sound pattern; and

one or more instructions for delivering a neural stimulus to the subject in association with the prompt, wherein the neural stimulus is delivered with a neural stimulator controlled by the controller and is adapted to enhance learning of the sound pattern by the subject.

33. A system for enhancing learning of a motor task by a subject, comprising:

a transcutaneous neural stimulator for delivering a neural stimulus adapted to enhance learning of a motor task by a subject;

a stimulator driver adapted to drive delivery of the neural stimulus by the transcutaneous neural stimulator;

a sensing system for sensing at least one parameter indicative of performance of the motor task by the subject;

a sound source;

a personal computing device including

a processor;

a display;

a data storage location;

an audio signal source adapted to drive delivery of a sound output by the sound source;

example module for controlling delivery of an example of the motor task to the subject via at least one of the sound source, the display, or a first additional output device;

prompting module for driving delivery of a prompt via at least one of the sound source or the display, in association with delivery of the neural stimulus by the neural stimulator, for prompting the subject to perform the motor task; and

performance assessment module for processing the at least one parameter sensed by the sensing system.

34. The system of claim 33, wherein the transcutaneous neural stimulator is incorporated into an ear bud, is incorporated into a head phone, is configured to fit into at least a portion of an ear of the subject, or includes a patch electrode.

35. The system of claim 33, wherein the sensing system includes one or more sensors that are attachable to the subject, built into a wearable item, attached to a wearable item, located in an item of athletic equipment, or located on an item of athletic equipment.

36. The system of claim 33, wherein the sensing system includes at least one of a dry electrode, epidermal electronics, an adherent accelerometer, a camera, an accelerometer, an inclinometer, a force sensor, a pressure sensor, a motion sensor, a temperature sensor, an optical sensor, an oxygenation sensor, or an EMG sensor.

37. The system of claim 33, wherein at least one of the first additional output device and the second additional output device includes at least one of a controllable compression garment, an electrical stimulation device, a force applying device, a vibrotactile device, or a haptic device.

38. A computer program product, comprising:

at least one non-transitory computer-readable medium bearing;

one or more instructions for presenting to a subject, via at least one of an audio output device and a visual output device under control of a controller of a personal computing device, a priming example of a complex motor task, the complex motor task including activation of a plurality of muscles;

one or more instructions for instructing the subject, via at least one of an audio output device and a visual output device under control of the controller, to mentally rehearse the complex motor task during at least one presentation of a rehearsal example of the complex motor task;

one or more instructions for providing to the subject, via at least one of an audio output device and a visual output device under control of the controller, a notification to the subject of a start of at least one presentation of the rehearsal example;

one or more instructions for presenting to the subject, via at least one of an audio output device and a visual output device under control of the controller, the rehearsal example;

one or more instructions for delivering to the subject, via a neural stimulus source under control of the controller, a learning enhancing neural stimulus during or immediately after at least one presentation of the rehearsal example; and

one or more instructions for repeating, under control of the controller, presenting the rehearsal example to the subject for a training period.

39. The computer program product of claim 38, wherein presenting the priming example includes presenting at least one of an audiovisual representation of the complex motor task, a visual representation of the complex motor task, or an audio sequence corresponding to the complex motor task.

40. The computer program product of claim 38, including one or more instructions for detecting performance of at least a portion of the complex motor task by the subject with a sensing system.

41. The computer program product of claim 40, including one or more instructions for providing feedback to the subject with a feedback system regarding performance of the at least a portion of the complex motor task by the subject.

42. The computer program product of claim 38, including one or more instructions for delivering a secondary stimulus to the subject with a secondary stimulus source.

43. The computer program product of claim 38, including

one or more instructions for creating a practice session schedule;

one or more instructions for storing the practice session schedule in a data storage location operatively coupled to the controller; and

one or more instructions for generating reminders for delivery to the subject via at least one user interface device operably coupled to controller to remind the subject of one or more practice sessions from the practice session schedule stored in the data storage location.

44. The computer program product of claim 43, including

one or more instructions for tracking, with a tracking module, practice session data relating to at least one practice session during which the subject practices the complex motor task; and

one or more instructions for storing the tracked practice session data in the data storage location.

45. The computer program product of claim 44, including one or more instructions for at least one of generating practice session trends or metrics based on one or more tracked practice sessions; reporting, with reporting circuitry, information regarding one or more tracked practice sessions, practice session trends, or practice session metrics to one or more of the subject, a parent, an instructor, a coach, a medical care provider, a peer, or a computing system; providing reports based on the tracked practice session data to a scoring module; assigning, with a scoring module, a score or ranking to the subject based on the performance of the subject during the one or more tracked practice sessions; assigning, with the scoring module, a score or ranking to the subject based on the subject's performance relative to the performance of one or more other individuals; transferring, with a reward module, a reward to the subject account based upon the tracked practice session data; or providing positive feedback to the subject via a user interface.

46. The computer program product of claim 38, including one or more instructions for sensing, with an attention sensor, at least one parameter indicative of attentiveness of the subject.

47. The computer program product of claim 38, wherein delivering the learning enhancing neural stimulus includes at least one of delivering a transcutaneous neural stimulus, delivering a stimulus to a cranial nerve of the subject, delivering a stimulus to a vagal nerve of the subject, delivering a stimulus to a trigeminal nerve of the subject, delivering a stimulus to a glossopharyngeal nerve of the subject, delivering a stimulus to a peripheral neural structure innervating a pinna of the ear of the subject, delivering a stimulus to a peripheral neural structure innervating an ear canal of the ear of the subject, or delivering a stimulus to a peripheral neural structure innervating a concha of the ear of the subject.

48. A computer program product, comprising:

at least one non-transitory computer-readable medium bearing

one or more instructions for presenting to a subject, via at least one of an audio output device and a visual output device under control of a controller of a personal computing device, a priming example of a complex motor task, the complex motor task including activation of a plurality of muscles;

one or more instructions for instructing the subject, via at least one of an audio output device and a visual output device under control of the controller, to mentally rehearse the complex motor task during at least one presentation of a rehearsal example of the complex motor task;

one or more instructions for providing to the subject, via at least one of an audio output device and a visual output device under control of the controller, a notification to the subject of a start of at least one presentation of the rehearsal example;

one or more instructions for presenting to the subject, via at least one of an audio output device and a visual output device under control of the controller, the rehearsal example;

one or more instructions for delivering to the subject, via a neural stimulus source under control of the controller, a learning enhancing neural stimulus during or immediately after at least one presentation of the rehearsal example; and

one or more instructions for repeating, under control of the controller, presenting the rehearsal example to the subject for a training period.