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(54) **APPARATUS AND METHOD FOR FUNCTIONAL STATE AND/OR PERFORMANCE ASSESSMENT AND TRAINING PROGRAM ADJUSTMENT**

(71) Applicant: **Valeriy Nasedkin**, Kauniainen (FI)

(72) Inventor: **Valeriy Nasedkin**, Kauniainen (FI)

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(57) **ABSTRACT**

An apparatus and method for training program generation and modification of that program based on assessed functional state and/or workload performance. User-interface logic preferably operating on a mobile device permits a user to record bio-signals indicative of functional state. Assessment-adjustment logic, that may be located at a distance, conducts body system assessments from the received bio-signal data and produces training session targets based on the current functional state of the user. User training objective data may be input through the user-interface logic. Workload performance may be monitored and the training session targets modified based on measured past performance to improve future performance. Various embodiments are disclosed.

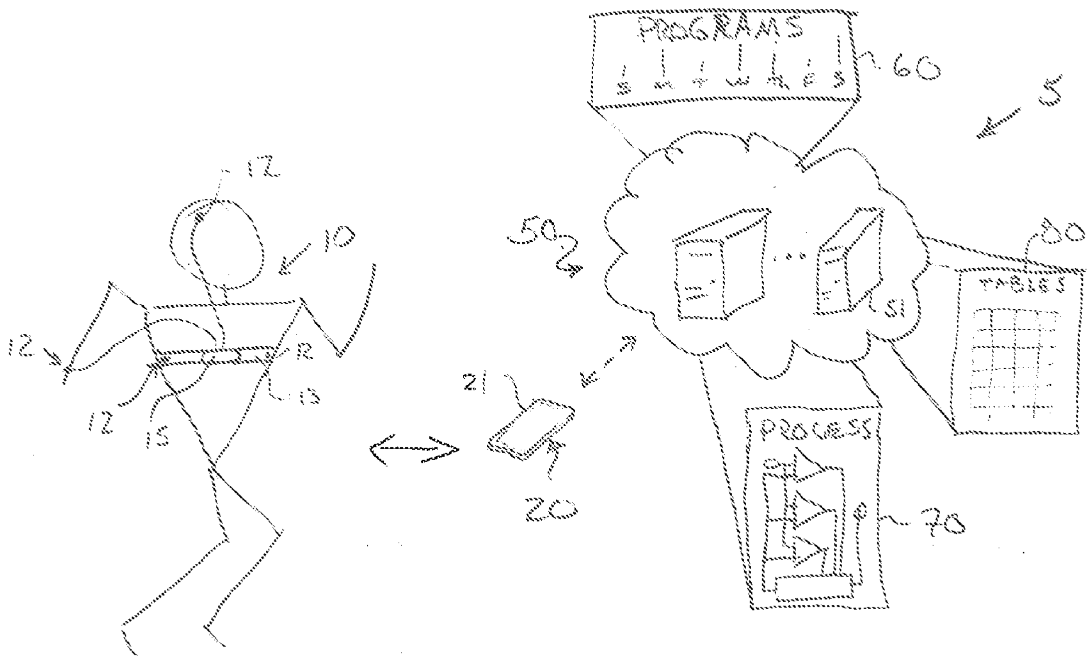
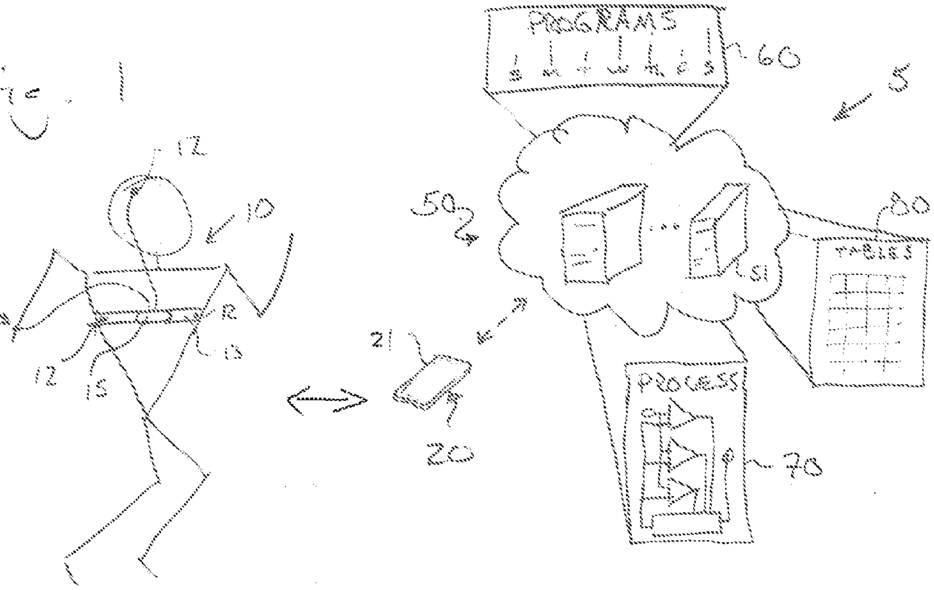


Fig. 1


PROGRAMS
60
5
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10
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51
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R
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21
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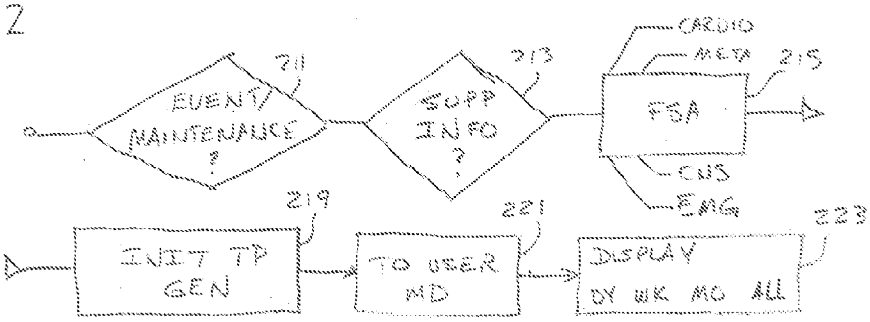
PROCESS
70

Fig. 2


CARDIO
META
211
213
215
EVENT/ MAINTENANCE ?
SUPP INFO ?
FSA
CNS
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221
223
INIT TP GEN
TO USER MD
DISPLAY
DY WK MO ALL

Fig. 3

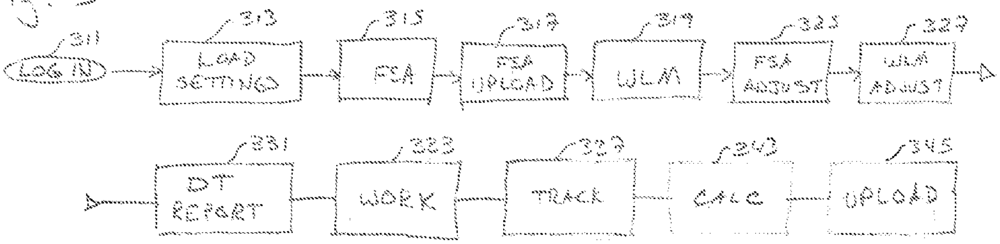


Fig. 4

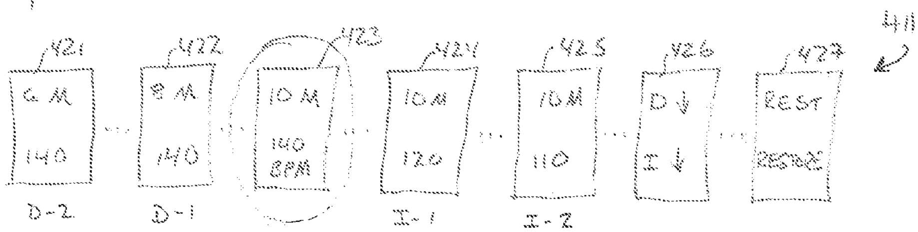
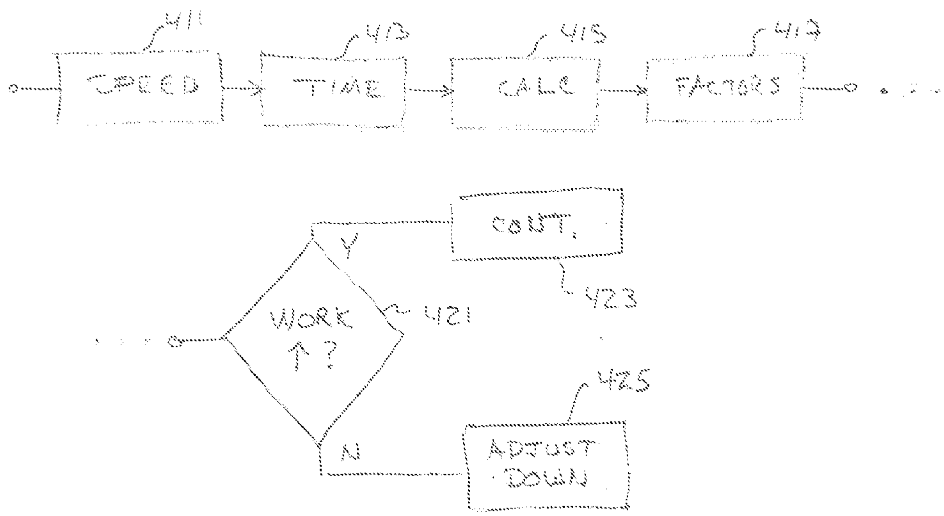


Fig. 5



APPARATUS AND METHOD FOR FUNCTIONAL STATE AND/OR PERFORMANCE ASSESSMENT AND TRAINING PROGRAM ADJUSTMENT

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is related to U.S. patent application Ser. No. ______, entitled Apparatus And Method For Assessing Functional State Of Body Systems Including Electromyography by Masakov, and filed on Jun. 6, 2013, which is hereby incorporated by reference as though disclosed herein. This application is also related to U.S. Pat. No. 6,572,558 issued to Masakov, et al., for an Apparatus and Method for Non-Invasive Measurement of Current Functional State and Adaptive Response in Humans which is hereby incorporated by reference as though disclosed herein.

FIELD OF THE INVENTION

[0002] The present invention relates to physical exercise training programs and, more specifically, to assessment of the current functional state of a person and/or the workload performed by the user and adjustment of a training program for that user based on assessment results.

BACKGROUND OF THE INVENTION

[0003] Various physical exercise training program models and devices are known in the art. They may be divided into five groups:

[0004] 1. Solutions that present a training program or schedule based on historically collected empirical data. These programs may be generic or specific and may cover a time period of a week to a year. For example, marathon training typically includes a 6-month training program with miles increasing each week and tapering towards the end.

[0005] 2. Solutions that assess the magnitude of the training load such as speed, distance, elapsed time, amount of weight lifted, etc.

[0006] 3. Solutions that monitor changes in heart rate and warn the user via an audio signal when his or her pulse moves above or below a predetermined heart rate zone.

[0007] 4. Solutions that assess the functional state of a person and provide information of the individual's current physiological state and may also provide an indication of heart rate zones for various levels of training loads.

[0008] 5. Solutions that are a combination of Solutions **3** and **4**.

[0009] While beneficial in advancing the field, prior art is disadvantageous in that it is not responsive to the individual needs or current physiological state of the person undergoing training. Generic programs may be inappropriate or not sufficiently accurate for a given individual. Furthermore, daily changes in the functional state of a person may make the dictates of a generic program inapplicable on a given day/period. If an athlete continues with the proscribed training regime when his/her functional state does not support it, then the athlete risks injury and/or a substantial setback in their training.

[0010] In addition, if an attempt is made to more closely analyze the training program and/or physiological assess the person using currently available technology, several disadvantages arise. These include, but are not limited to, a significant amount of time is/may be required, multiple assessments are needed, and exercise is interrupted during assessment, among other disadvantages.

[0011] Thus, a need exists to expediently and/or contemporaneously capture the data indicative of the functional state of a subject under test (SUT), to assess this data to determine current functional state, and to adjust a training program in response thereto to improve the training process and therefore deliver better physical performance to the user. A need further exists to achieve the above in a manner that is convenient, lightweight, easy-to-use and effective.

[0012] Prior art systems are further disadvantageous in that they do not assess the work performed nor adjust the training program as needed based on the workload assessment.

SUMMARY OF THE INVENTION

[0013] Accordingly, it is an object of the present invention to provide and assessment and training program adjustment system that addresses the shortcomings of the prior art.

[0014] It is another object of the present invention to provide such a system that assess the functional state of a user and modifies a prospective training program based on the functional state assessment.

[0015] It is also an object of the present invention to provide such a system that measures the workload performed by the user and modifies a prospective training program for improved performance.

[0016] These and related objects of the present invention are achieved by use of an apparatus and method for functional state and/or performance assessment and training program adjustment as described herein.

[0017] The attainment of the foregoing and related advantages and features of the invention should be more readily apparent to those skilled in the art, after review of the following more detailed description of the invention taken together with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] FIG. **1** is a diagram of one embodiment of a physical state assessment and training program adjustment system in accordance with the present invention.

[0019] FIG. **2** is a block diagram illustrating one embodiment of initial training program generation in the system of FIG. **1**.

[0020] FIG. **3** is a flow diagram illustrating daily (or other period) use of the system of FIG. **1**.

[0021] FIG. **4** is a spectrum of potential Day Targets.

[0022] FIG. **5** is a flow diagram of computer workload measurement calculation and its influence on Day Target generation.

DETAILED DESCRIPTION

[0023] Referring to FIG. **1**, a diagram of one embodiment of a physical state assessment and training program adjustment system **5** in accordance with the present invention is shown. System **5** preferably operates in concert with the mobile device platform or environment, to afford the convenience and mobility of that platform. In addition, mobile device communication permits real-time assessment of the workload performed by the user. The user-interface that operates on the mobile device to carry out the present invention may evolve as mobile communication evolves without departing from the present invention.

[0024] System **5** may include a sensor and transmitter unit (SATU) **10**, user-interface logic **20** that executes on mobile device (MD) **20** and processing logic (PL) **50** that may execute on a cloud-based computer (or other processor) **51**. The interface logic may be invoked as an application executing on the mobile device, termed, for example, Adaptive Training application. Depending on the magnitude of the processing load and the power of the mobile device, processing may take place on the cloud and/or the mobile. It is anticipated that initially more robust processing will occur on the cloud computer, yet as mobile device technology improves, some or all of the assessment processing may move to the mobile device, particularly for less robust assessment/adjustments.

[0025] For pedagogical purposes, the system of FIG. **1** will be described with the assessment and program adjustment logic operating primarily on the cloud computer **51** though it is to be understood that this processing may move to the mobile device to the extent the mobile device can support it, or another computing device.

[0026] As illustrated diagrammatically in FIG. **1**, components of logic **50** may include:

- **[0027]** (1) a database or library or the like **60** for generation of initial training programs;
- **[0028]** (2) sorting and processing procedures **70** to assess functional state and performed workload, and to make adjustments to the training program (TP); and
- **[0029]** (3) various look up tables or the like **80** used in carrying out the functions of the AAL. These are discussed in more detail below.

[0030] The SATU **10** may take many forms without departing from the present invention. In one embodiment, the unit includes a plurality of sensor electrodes **12** that are capable of measuring bio-signals such as cardiac, brain wave and/or electrical muscle signals. Such sensors are known in the art. These sensors are connected to a transmitter or transceiver **15** that is capable of transmitting the sensed signals to the MD **20**. The SATU to MD connection it is preferably wireless, though it may be wired. A suitable wireless SATU is taught by in co-pending U.S. patent application Ser. No. ______, referenced above, with sensors **41-46** and transmitter pod **50**. Note, alternatively, that the SATU may be wired and the wiring may connect directly to a port on the mobile device, with appropriate channel amplifiers, filters, converters built into the wired connection and/or the MD. In this latter instance, the pod **50** of the co-pending application may not be needed. Furthermore, wireless sensors (ie, sensors with built in transmitters) may be used and may communicate directly to MD **20**.

[0031] MD **20** is any suitable MD, and may take the form of a mobile phone, tablet computer, Blackberry®, or other mobile electronic communications device. MD **20** and/or SATU may include GPS (standard on most cell phones), accelerometers, gyroscope, altimeter and/or other sensing or positioning technology, e.g., thermometer, wind-direction/speed detector, humidity meter, etc., for real time data collection. These positioning, environmental and other parameter measuring sensors may be represented generally with reference numeral **14**.

[0032] The SATU **10** may also include an adjustable belt **13** that can be worn around a user's chest or elsewhere, and the transceiver/transmitter **15** that can be attached to the belt (or otherwise supported by the user). The GPS, accelerometer, gyroscope, altimeter, thermometer and/or other sensing/positioning technology **14** may be provided in or with (i.e., connected to) the transmitter **15** (if not otherwise provided on the user or in the mobile device, etc.). Placement of these sensors on the user (for example, with transmitter **15**) gives an accurate measure of a user's movement for workload calculation.

[0033] The adaptive system of the present invention functions, in one embodiment, by establishing a training program (TP), assessing the current functional state of a user, assessing the workload performed by a user, and appropriately modifying the training program based on the assessed functional state and/or the workload measurements to provide a more optimum and effective overall training experience.

[0034] Referring to FIG. **2**, a block diagram illustrating one embodiment of initial training program generation is shown. A user is prompted for his or her training parameters (**211**). Questions may include:

- **[0035]** Are you training for an Event or Maintenance?" If training for an Event, they may continue:
- **[0036]** What is the Distance?
- **[0037]** When is Event?
- **[0038]** What is your desired Pace?

If the user indicates Maintenance rather than a Event, a similar list of questions is generated to determine the desired training program parameters. These questions might include historic run training, current physical state self-assessment, maintenance performance goals, etc.

[0039] For purposes of illustration, the assumed answers to the above questions above are: Event, Marathon, 6 months, and 3H20 pace, respectively. Other information such as age, gender, height/weight, injury information, physical state self-assessment (e.g., state-stated fitness level), medical conditions, etc., may be elicited from a user (step **213**). In step **215**, an initial functional state assessment (FSA) is conducted to determine an initial or baseline physical state of the user. This information is used to create the initial TP (as discussed below). The FSA may be conducted at rest and does not require the user to perform an initial load, e.g., run five miles. The present invention is unique in being able to assess functional state (readiness for exercise) without an initial load performance, and using the assessment result to more accurately craft an initial TP.

[0040] Various body system tests may be investigated during an FSA including cardiac, metabolic, central nervous system (CNS), hormonal, and electromyography (EMG), among others. These body system tests provide a picture of the current functional state of the user (and readiness for work) without historical knowledge of a person's physical training regime or subjecting the user to a test-load. For example, the metabolic assessment (preferably derived from a differentiated ECG type signal) may give an indication of anaerobic threshold, important for use in generating an initial target heart rate. Heart Rate and/or Heart Rate Variability (among other body system assessments) may be used to determine sympathetic and parasympathetic nervous system states, which are important in generating initial distance and intensity targets, etc., as discussed in more detail below.

Anaerobic Threshold

[0041] The metabolic assessment of the FSA is used to determine AT which in turn is used to generate an initial target heart rate (to maximize aerobic performance). Metabolic assessment is taught in U.S. Pat. No. 6,572,558 referenced above and Publications of Kiev Sports Medicine University by Beregovog, V. Y., or Dushanin, S. A. (1986).

[0042] Anaerobic exercise is exercise intense enough to trigger lactic acid fermentation. It is used by athletes in non-endurance sports to promote strength, speed and power and by body builders to build muscle mass. Muscle energy systems trained using anaerobic exercise develop differently compared to aerobic exercise, leading to greater performance in short duration, high intensity activities, which last from mere seconds to up to about 2 minutes. Any activity lasting longer than about two minutes has a large aerobic metabolic component.

[0043] The anaerobic threshold, also known as the lactate threshold, is the exercise intensity at which lactate (more specifically, lactic acid) starts to accumulate in the blood stream. This happens when lactate is produced faster than it can be metabolized in the muscle. When exercising at or below the AT, any lactate produced by the muscles is removed by the body without it building up. With a higher exercise intensity the lactate level in the blood reaches the AT, or the onset of blood lactate accumulation. The AT is a useful measure for deciding exercise intensity for training and racing, particularly in endurance sports (e.g. long distance running, cycling, rowing, swimming and cross country skiing), but varies between individuals and can be increased with training.

[0044] The FSA of step **215** returns data used in a differentiated ECG assessment to identify and/or closely approximate the AT of a user, and the target heart rate, BPM, that corresponds with that AT.

[0045] The event information **211**, any relevant supplemental data **213**, and FSA data **215** is preferably propagated to PL **50**. Step **217** represents receipt of these data packets at PL **50**.

[0046] Marathon training requires a certain number of miles per week, and a ramp up and ramp down in that number. A considerable amount of known research has been conducted to establish generic or boilerplate training programs. These may be found in the literature. A typical training program is 6 months. The program is often divided into weeks, and daily targets established within those weeks. For example, within a week, days of short runs, long runs and rest may be established. Target pace is often selected by the user, in conventional training programs, from past performance or selected as a goal.

[0047] While prior art training programs tend to rely on selection of a target pace by the user (or coach), the present invention preferably specifies a target heart rate determined by reference to AT and expressed in beats for minute (BPM).

[0048] PL **50** may default to a conventional training program (pre-FSA) for initial distance numbers (in generating a prospective TP). The FSA results then preferably considered to provide the initial intensity. The PL **50** may further modify the prospective TP based on other FSA data to arrive at an initial TP that is customized to the user (step **219**). This will give miles per week, and workouts per day, and preferably be expressed in distance and heart rate targets, rather than distance and pace proscriptions. Step **221** represents propagation of the initial TP to a user.

[0049] The initial TP may be viewed on MD **20** by Day, Week, Month, ALL or other (step **223**), though what is particularly relevant is the target for the current day as future targets will likely change based on future FSA results and workload measurements (WLMs). Display of tentative future training targets may be helpful to a user in the general scheduling of their day-to-day affairs. Interface logic **20** may be configured with the MD software so that the training program is integrated into the calendar and alarm functions of the user's mobile device, so that a user may schedule their work-out time in advance and be alerted by their MD. Food intake needs that support the proscribed physical activity may also be sent to MD **20** for display and integration into the MD's scheduling system, to assist a user in timely and appropriate food selections.

Use in Training

[0050] Referring to FIG. **3**, a flow diagram illustrating daily (or other period) use of training system **5** is shown. This could be for day 21, 57, 132 or any other given day, though if for day 1, there would be no workload history.

[0051] The user preferably logs in, step **311**. Processing logic **50** loads the user's settings including the prospective Day Target for that day, step **313**. The user is prompted for conducting a pre-load FSA, step **315**. This prompting may include prompts for correct sensor placement and then sequentially stepping the user through the appropriate FSA test steps. In step **317**, the results data is sent to PL **50**. In step **319**, PL **50** retrieves or uploads the most recent WLMs (performance history of the user). The FSA results and the WLMs of steps **317** and **319**, respectively, are used to modify the prospective Day Target. The criteria for and manner of making DT adjustments are discussed in more detail further below.

[0052] In step **325**, the prospective TP is modified, if necessary, based on the FSA results. In step **327**, the FSA-adjusted prospective TP is modified, in necessary, based on WLMs. In step **331**, the target training program for the current day (i.e., a Day Target) is present to the user. In step **333**, the "work" begins. This Start may be initiated by a user pushing Start on the user-interface or the sensors sensing movement of the user and initiating tracking, etc.

[0053] The workload parameters are preferably tracked in real-time, step **337**. During the proscribed run, the user may be alerted if they vary from a proscribed BPM, pace, smoothness or other parameter. At completion of the work, the user may press an END button, or the sensors may END based on detected stopping (for longer than a traffic light, etc.), step **339**. The user may be prompted for confirmation. Workload measurement calculations are preferably performed, step **343**, and the WLMs uploaded to PL **50**, step **345**, so they are available during step **319** above as the preceding day's WLM.

Influence of FSA and WLM

[0054] Referring to FIG. **4**, a spectrum **411** of potential training targets for a given training session is represented. Often there will be one training session per day, yet depending on the training program there may be multiple sessions in a day. Thus the training targets may be referred to as session targets or STs. While only one ST is likely shown to a user, PL **50** may be configured to create session targets along a spectrum of different intensity and volume specifications. In the example of FIG. **4**, ST **423** is a "prospective" and pre-FSA ST. The actual ST presented to the user, however, may shift to the left or to the right along the spectrum. Note that intensity and volume parameters may differ based on the type of athletic event. For distance running, the intensity parameter is preferably heart rate or BPM and the volume parameter is preferably distance. In other athletic pursuits, intensity might include number of repetitions or repetitions in a certain time period, and volume might include weight lifted or height climbed, etc.

[0055] In step **325** of FIG. **3**, PL **50** investigates the results of the FSA of step **315**. If all the relevant body systems are in sufficiently good condition, then target **323** is presented to the user. If, however, the results of the FSA suggest that one or more body systems are not optimal then another ST is presented. The "other" ST may have a reduced workload requirement and the type and magnitude of the reduction will depend on the FSA results.

[0056] In target **322**, the "intensity" or BPM is maintained, yet the miles are reduced. In target **321**, the miles are reduced even further, while intensity is unchanged. In target **324**, conversely, the distance is maintained, but the intensity is reduced (slower run) and in ST **325**, the intensity is reduced even further. ST **326** indicates a reduction in both distance and intensity, i.e., the user has a rather reduced state of readiness. ST **327** indicates rest or restorative therapies, i.e., the user is rather depleted. The intensity and distance proscriptions are influenced by the sympathetic and parasympathetic nervous systems, and other body systems.

Sympathetic/Parasympathetic Nervous Systems

[0057] The sympathetic and parasympathetic nervous systems (SNS, PSNS) are the two main divisions of the autonomic nervous system (ANS). The ANS is responsible for regulation of internal organs and glands, which occurs unconsciously. To be specific, the sympathetic nervous system is responsible for stimulation of activities associated with the fight-or-flight response. The parasympathetic system is responsible for stimulation of "rest-and-digest" activities that occur when the body is at rest, especially after eating, including sexual arousal, salivation, lacrimation (tears), urination, and digestion. Sympathetic and parasympathetic divisions typically function in opposition to each other, though in a complementary rather than antagonistic manner. The sympathetic division typically functions in actions requiring quick responses. The parasympathetic division functions with actions that do not require immediate response.

[0058] It is known in the art that heart rate variability evaluation may be used to assess the state of the SNS and PSNS. Good SNS levels indicate a person's ability to run a long distance, but do not well address intensity. Good PSNS levels indicate a person's ability to perform at higher intensity, but do not well address endurance and the ability to run long. Hence, when PSNS levels are high, but SNS levels are low, the ST shifts to the left and ST **322** or **321** is selected, based on the relative magnitude of PSNS and SNS levels. If the converse is found, the selected ST shifts to the right to the appropriate one of ST **324** and **325** (assuming other body system results are satisfactory).

[0059] If both SNS and PSNS are not within a sufficiently adequate range or another body system is low in combination with a low SNS or PSNS, then ST **326** may be selected. There may be a reduction to 8 miles at 120 BPM or 6 miles at 110 BPM, or other values or combinations, depending on the gravity of the FSA values. Further, a very strong negative FSA value in one body system parameter or an accumulation of lower FSA values (across multiple body systems) may indicate the need for rest—a day off—or, if lower yet, restorative activities such as massage, acupuncture, etc.

[0060] In addition to metabolic (DECG, AT, BPM) and cardiac (HRV, SNS/PSNS, Intensity/Distance), other body systems measurements may influence session target selection/creation. These include: DC Potential, Hormonal, Detoxification, Gas Exchange/Pulmonary and EMG, among others. The first four of these may be achieved using an omega brain wave test as described in the '558 patent, and the EMG test may be achieved using an EMG test as described in the co-pending application.

[0061] In essence, each of these tests has a normal range of results and the range can vary from person to person. The results for all of these tests are characterized in having an excitation component and an inhibition component. Thus, each test result may have an excitement result of: too excited, norm or not excited enough and an inhibition result of: too inhibited, norm, not inhibited enough. The adjustment to the training program will be to bring the user back towards a "norm" for each body system.

[0062] For example, if the CNS test (omega wave-DC potential) returns a low level, then this infers that the CNS is inhibited. High mental work or power exercise is not recommended. If the hormonal system is below a norm, then maximum velocity is not recommended. If the HR test returns a state of over excitement, then a reduced vigor workout is proscribed, to bring the excitement level back towards the norm.

[0063] For each body system assessment and correction, the path is rather linear—over/under and amount. The aggregate of the corrections/adjustments may be non-linear, however, due to the multiple body system factors influencing the adjustments.

[0064] Referring to FIG. **5**, a flow diagram of computer workload measurement calculation and its influence on ST generation is shown.

[0065] Step **327** of FIG. **3** represents adjustment of the TP based on WLM. For running, a desired goal is to increase speed and/or distance at speed. Thus, while the FSA tracks the functional state of the body at a given moment, it does not detect performance. The detection of performance provides feedback on whether the proscribed TP is actually working and providing the desired results.

[0066] A primary measure of workload is distance and speed. Assuming the same or approximately same training conditions (elevation, wind speed, etc.), then, week by week, for example, improvements in performance should be detected. If the performance is not improving (speed decreasing, targets not being met or increasingly missed, etc.), then the body is likely being driven too hard. To address this, the spectrum of day targets is preferably shifted down, which may be achieved primarily through reducing intensity, BPM. Mileage may be dropped though preferably merely to let the body recover and is then increased so that requisite mileage is achieved.

[0067] Furthermore, the WLM may be fine tuned by accounting for other factors such as elevation, windspeed, traffic light stoppage and other factors. An appropriate mathematical value can be assigned to one or more of these factors (and relative magnitude accounted for) and incorporated into the workload measurement calculation.

[0068] Thus, a first part of FIG. **5** represents determination of WLM (that generated in step **343** of FIG. **3**). The distance (GPS) and time (clock) of the run is measured and a speed calculated, step **411**, **413**, **415**. In step **417**, the speed value may be adjusted for any of the condition factorials, etc.

[0069] The lower part of FIG. **5** illustrates comparison of the WLM, which may occur on a daily (or other) basis, yet for a period extending back one to several weeks (or more), step **421**. If the performance is improving, no change in made to the TP, step **423**. If, however, performance is not improving then the Session Targets are adjusted, preferably as discussed above (shifted down), step **425**.

[0070] It should be recognized that in addition to proscribing miles, intensity and other physical acts, the PL **50**, through its database and processing ability, may also provide a user with nutritional information proscriptions to support the physical activity in the SDTs. This nutritional information may include the type of food to eat (protein, vitamin-rich, carbohydrate-rich, etc.), serving size, caloric intake, and other information, on a day-to-day (or other period) basis.

[0071] The above example is for marathon training. It should be further recognized that the present invention applies to other activities including longer and shorter distance running, sprinting, swimming, cross-country skiing, and cycling activities, etc. While well-suited for aerobic activities, it may also be used for anaerobic conditioning, i.e., providing repetitions and weight/resistance, and weight-lifting, etc.

[0072] While the invention has been described in connection with specific embodiments thereof, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth, and as fall within the scope of the invention and the limits of the appended claims.

1. An apparatus for physical assessment and training program adjustment, comprising:

interface logic adapted for execution on a mobile device that has the capability of communicating with body sensors;

assessment-adjustment logic (AAL) adapted for execution on a computer located at a distance from a mobile device on which the interface logic executes;

wherein the interface logic is configured to receive bio-signals for a functional state assessment of a user;

wherein the AAL is configured to conduct a functional state assessment of the user from the received bio-signals and to produce a functional state assessment test result therefrom, and further to create a session target for a given training session that is based on the current functional state of a user as indicated by the functional state assessment test result.

2. The apparatus of claim **1**, wherein the interface logic is configured to received desired training objective data from a user; and

wherein the AAL is configured to create the session target based on the training objective data and the functional state assessment test result.

3. The apparatus of claim **1**, wherein the AAL is configured to assess an anaerobic level of the user during the functional state assessment and to generate an intensity target within the training session target that corresponds to the assessed anaerobic level.

4. The apparatus of claim **1** wherein the AAL is configured to assess a parasympathetic nervous system (PSNS) level and a sympathetic nervous system (SNS) level of a user during the functional state assessment, and to select a volume target and an intensity target as part of the training session target based on the assessed level of the PSNS and SNS of that user.

5. The apparatus of claim **1**, wherein the AAL is configured to perform a functional state assessment that includes two or more of:

ECG test;

Differentiated ECG test;

omega brain wave test; and

electromyography test; and

wherein the AAL produces test values for these two or more tests, the test values forming part of the functional state assessment test result and being processed by the AAL to influence the training session target.

6. The apparatus of claim **5**, wherein the AAL is configured to compare the test values to a norm and influence the session target in a direction that moves subsequent test values towards that norm.

7. The apparatus of claim **1**, wherein the interface logic is further adapted for execution on a mobile device that has the capability of communicating with user workload sensors; and

wherein the interface logic receives user workload data and channels the user workload data to the AAL; and

wherein the AAL produces a workload measurement and influences the training session targets based on the workload measurement.

8. The apparatus of claim **7**, wherein the AAL is configured to assess multiple historic workload measurements from a given user to determine a trajectory of performance and to influence the session target towards improved performance based on the trajectory determination.

9. The apparatus of claim **7**, wherein the AAL is configured to produce a condition factor that is incorporated into the workload measurement to account for one or more of elevation and resistance in production of the workload measurement.

10. The apparatus of claim **1**, wherein the session target includes an intensity target and a volume target and the AAL is configured to reduce both the intensity target and the volume target, if the functional state assessment test result indicates low conditions in one or more of the body systems including: cardiac, metabolic, central nervous system, hormonal, detoxification and EMG.

11. The apparatus of claim **4**, wherein the AAL is further configured to create the session target with a decreasing volume yet maintain intensity substantially constant when the PSNS level is high relative to the SNS level and to decrease intensity yet maintain volume substantially constant when the SNS level is high relative to the PSNS level.

12. An apparatus for physical assessment and training program adjustment, comprising:

interface logic adapted for execution on a mobile device that has the capability of communicating with user workload sensors; and

assessment-adjustment logic (AAL) adapted for execution on a computer located at a distance from a mobile device on which the interface logic executes that is configured to create a session target for a training session that includes an intensity target and a volume target;

wherein the interface logic receives user workload data and channels the user workload data to the AAL;

wherein the AAL is configured to produces a workload measurement indicative of the workload performance of a user and to adjust a subsequent session target for that user in a direction toward performance improvement.

13. The apparatus of claim **12**, wherein the AAL is configured to assess multiple historic workload measurements from a given user to determine a trajectory of performance and to influence the session targets towards improved performance based on the trajectory determination.

14. The apparatus of claim **12**, wherein the AAL is configured to perform a functional state assessment that includes two or more of:

ECG test;

Differentiated ECG test;

omega brain wave test; and

electromyography test; and

wherein the AAL produces test values for these two or more tests and the test values are processed by the AAL to influence the session target.

15. The apparatus of claim **14**, wherein the AAL is configured to compare the test values to a norm and influence the session target in a direction that moves subsequent test values towards that norm.

16. The apparatus of claim **14**, wherein the AAL is configured to assess an anaerobic level of the user during the functional state assessment and to generate an intensity target within the training session target that corresponds to the assessed anaerobic level.

17. Apparatus for physical assessment and training program adjustment, comprising:

interface logic adapted for execution on a mobile device that has body sensors communication capability and a GPS unit;

assessment-adjustment logic (AAL) adapted for execution on a computer located at a distance from a device on which the interface logic executes;

wherein the interface logic receives bio-signals from a user and workload data (WLD) from that user and forwards the bio-signals and WLD to the AAL;

wherein the AAL includes bio-signal assessment logic that (a) creates, from the received bio-signals, functional state values that are indicative of the state of a body system to which the given bio-signal corresponds and (b) creates, from the received workload data, a workload measurement that quantify a workload performed by the user;

wherein the AAL comprises training program adjustment logic that based on the functional state values and the quantified workload measurement generates electronic signals that are representative of a session target for the user for a given training session.

18. The apparatus of claim **17**, wherein the interface logic is further configured to received desired training objective data from a user; and

wherein the AAL is further configured to create the session target based on the training objective data, the functional state values and the workload measurement.

19. The apparatus of claim **17**, wherein the AAL is configured to assess a parasympathetic nervous system (PSNS) level and a sympathetic nervous system (SNS) level, and to select a volume target and an intensity target as part of the session target based on the assessed level of the PSNS and SNS of that user.

20. The apparatus of claim **17**, wherein the assessment logic conducts two or more of the following body system tests:

ECG test;

Differentiated ECG test;

omega brain wave test; and

electromyography test.

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