Applied Mathematical Science of Physical Training Part 3: Preparedness

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1. Executive Summary

This work will detail the protocol to determine the real-time Preparedness of an athlete/trainee in relation to the training/competition process.

Preparedness is a cumulative factor that arises from the interplay of two short-term effects that result from the application of a training load: Fitness and Fatigue.

I will detail protocols for defining representational values for both fitness and fatigue and determining the times-to-full-decay from both.

I will describe a robust logic for defining a maximal level of fatigue and its time to complete decay. I will determine how other fatigue values relate to this maximum in terms of percentage and how this generates the amounts of time to complete decay for all values.

I will provide a method to autoregulate the time to full fatigue decay, ensuring that the preparedness value will become increasingly precise over time.

A clear and rigorous methodology for determining an athlete's Preparedness for high-level performance will be complete by the end of this paper.

2. Introduction

The transitory factor that determines an athlete's success in any competition or performance is their *preparedness* at the moment of the match/game. It does not matter if the athlete has developed a high level of potential (Form) through the training process if they are not "prepared" to excel at game-time. The essential task of coaches and trainers who train athletes is the development of preparedness for specific critical moments in the competitive schedule. Fundamentally, coaches want athletes' preparedness as high as possible for all competitions, especially the important ones.

Preparedness is transitory in relation to the more stable performance factor known as Form. Form is the cumulative long-term training effect of training represented by an athlete's reaction time, speed, power, strength, and endurance levels *when fresh*. Adaptations relating to Form take substantial time to develop and are relatively stable. Form is related to long-term neural/structural/bioenergetic adaptations, while preparedness is related to short-term neural/bioenergetic adaptations.

Form can is the baseline physicality of the athlete to which a training load is applied. When the load is applied, the (short term) fitness and fatigue effects arise from the baseline, and the balance of these variables is Preparedness. Preparedness is then a momentary balance of fitness and fatigue at any point in the training/competition process.

An athlete with superior Form will have a potential advantage over a weaker one. However, the weaker athlete may still prevail if they have greater preparedness at the time of the encounter. This paper will give the reader a usable method to predict preparedness across time according to a training program, providing a precise methodological tool to “peak” athletes for serious competitions and performances.

The Actual Internal Training Load concept from my first two works is the point of departure for this work. It is essential to read and understand those works before embarking on this one.

3. The Two Factor Theory Of Training

The two-factor theory of training, or Fitness-Fatigue theory, states that two fundamental effects result from applying a training session to an athlete: *Fitness* and *Fatigue*. The fitness effect is positive, and the fatigue effect is negative. The fatigue effect is more significant in magnitude, while the fitness effect lasts longer; this is why the training process improves an athlete’s physicality over time.

Fitness is essentially a neural phenomenon. The improvement in fitness from a training session lies in increased cognition related to athletic movement, improved motor control, and neural integration/firing sequencing. When we lift weights, run, jump, and so forth, the brain takes in data to improve movement control and skill, and our neural networks improve integration and firing sequencing to produce speed, power, and force as required.

Fatigue is essentially a structural and vegetative phenomenon. Fatigue is caused mainly by protein breakdown in working muscles, glycogen (energy) depletion in the liver, and glycogen/phosphagen in muscle cells. Over time, the recovery from fatigue causes long-term positive structural and vegetative adaptations, like increased muscle mass, bone density, and liver/cellular energy storage.

The balance of Fitness and Fatigue after a training session is *preparedness*. Figure one shows a graphic representation of a single session's fitness and fatigue effects.

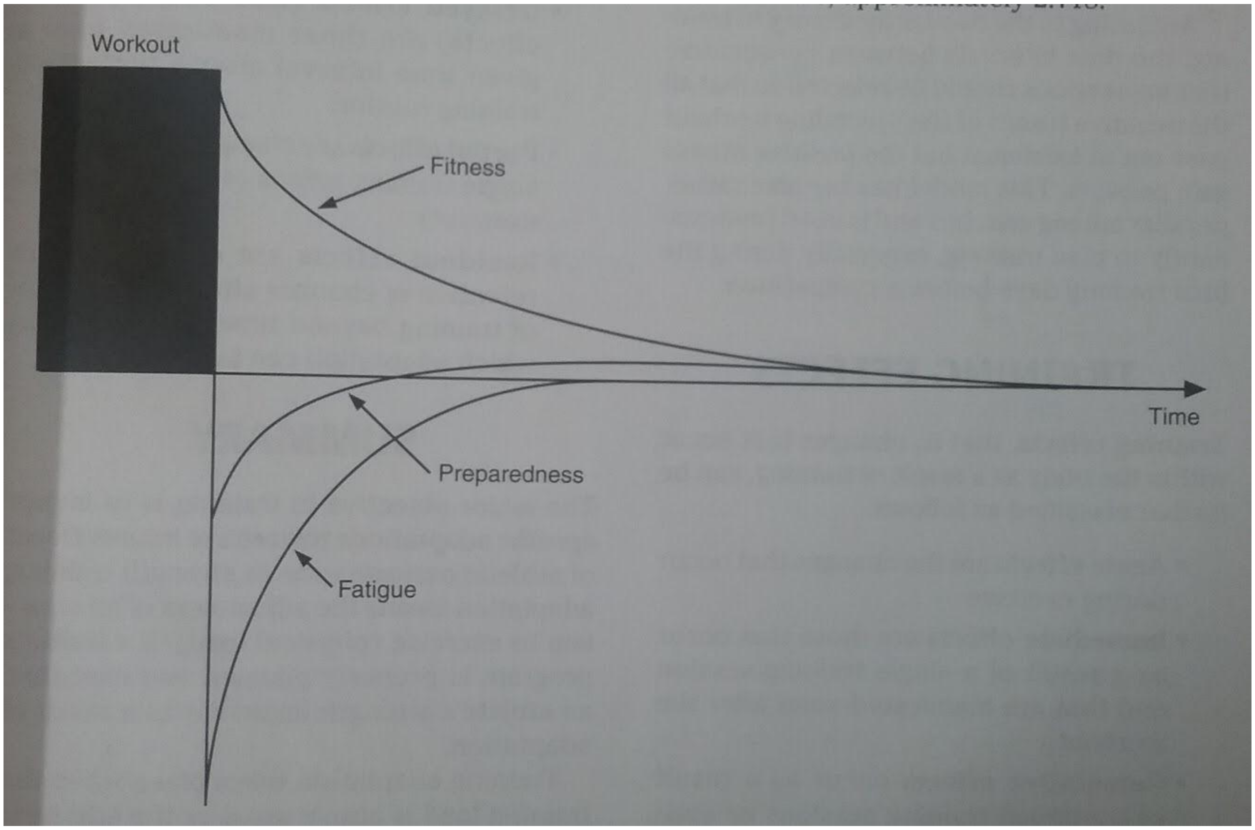

Figure 1: Model Of The Two Factor Theory Of Training

4. Defining Fatigue

To practically use Two-Factor Theory in the training process, we must determine the actual values of the factors. Fatigue from a training session is directly related to the amount of internal training load developed in the session.

In the first paper, I detailed the protocol for determining the Actual Internal Training Load for lifting actions, activities, sessions, and days. In the second, I expanded the system to include all forms of "body across terrain" movement, from flat track running to hill running to vertical climbing. The Actual Internal Training Load fundamentally *is* Fatigue. The Actual Load value from a session is the exact amount of Fatigue. From here on, we will use Actual Internal Training Load and Fatigue interchangeably.

4.1 Maximum Fatigue Load

Table 1 (table 10 from the second paper) shows the Actual Internal Training Loads of various training sessions and competitions from the worlds of both lifting and running.

Activity	Actual Internal Load
Prilepin Light Activity	0.54
1: 100 M Sprint	0.56
Prilepin Optimal Activity	0.94
1: 200 M Sprint	1.12
Competive Bench Press	1.58
Competitive Snatch	1.89
1: 10,000 M Run	2.14
Competive Powerlifting Squat	2.71
Medium Session	2.95
15 Kilometers Run	2.95
Competitive Clean & Jerk	3.11
Sprintingworkouts.com Large Speed-Endurance Session	3.62
Large Session	3.74
Half Marathon	4.18
Large Training Day	4.52
Modern Weightlfitng Meet	5.00
Very Large Training Day	5.23
30 Kilometers Run	5.38
Standard Powerlifting Meet	6.94
Marathon	7.60
Powerlifting Meet w/ Strict Curl	7.90
100 Mile Run	18.94

Table 1: Actual Internal Training Loads.

At the bottom of table 1, we see that a 100-mile run is a load of 18.94. A 100-mile run represents the extremity of the amount of exercise a human being can withstand in a day (more than three Marathons combined!). Logically we will define the Fatigue from this activity as the Absolute Fatigue (AF) value and consider it the point beyond which the athlete's organism will experience mechanical failure (injury) if they do not cease activity. Of course, the athlete would be able to walk to their car and into their house after the run. Still, after an 18.84 Load, they would not have the capability to perform further physical (or mental/psychological for that matter) work that even approaches strenuousness. We will relate all other fatigue loading values to 18.94 to determine their percentage of the absolute.

4.2 Percentage Of Absolute Fatigue From a Given Load

To determine what percentage of absolute a given load is, we must determine what percentage the load is of 18.94. As an athlete does work, fatigue accumulates in their organism exponentially rather than incrementally. Determining the percentage of fatigue from a load is not as simple as dividing the loading value by 18.94. We must employ an exponential function to determine the actual level of fatigue experienced by the athlete.

To determine what percentage of the AF load as a given load is, we must first turn it into a value that relates to the AF load in an exponentially decreasing way. The following equation raises the base (zero fatigue) by an exponent that is the product of the percentage the load is of the Absolute Fatigue load and the logarithm of the AF load to the base (thus making the exponent proportional to the percentage of the AF load the given load is).

((Base^((((Load/AF Load))*(LOG((AF Load + Base),Base))))))-Base = Fatigue Load value

This equation produces a precise value for fatigue for loads from 0.001 to 18.94. Since 0 and 1 cannot be used as a base, I used 1.001 and subtracted it from the product at the end of the equation, effectively allowing the base to be 0.

To determine the percentage of AF from any action (rep or set), activity (exercise), or session load, we divide the Fatigue Load value (FLV) by the Absolute Fatigue Load value (18.94). The results from various competition and training loads are in table 2.

Activity	Actual Internal Training Load	Fatigue Load Value	% Of Absolute Fatigue
Optimal Bench Press Activity	0.75	0.13	0.69%
Optimal Snatch Activity	0.90	0.15	0.79%
Optimal Powerlifting Squat Activity	1.30	0.23	1.22%
Moderate Workout	3.04	0.62	3.28%
Heavy Workout	3.74	0.81	4.29%
Modern Weightlifting Meet	5.00	1.21	6.40%
Historic Weightlifting Meet	6.60	1.84	9.74%
Powerlifting Meet	6.94	2	10.58%
Marathon	7.60	2.33	12.33%
Powerlifting Meet With Strict Curl	7.90	2.49	13.17%
100 Mile Run	18.90	18.9	100.00%

Table 2: Fatigue Load values and Percentages of Absolute Fatigue from various activities.

4.3 Days Of Fatigue Accumulated

As each load applied in training develops a certain FLV and percentage of Absolute Fatigue, this value will manifest in the trainee as physiological fatigue effects for a certain amount of *time. A*cademic literature commonly refers to This amount of time as "time to full fatigue decay." I will refer to it as "Days of Fatigue Accumulated." (DFA)

Since each load's FLV is a percentage of the AFLV, its DFA will be a percentage of the AFLV DFA. The AFLV's DFA is called the AF DFA (Absolute Fatigue Days of Fatigue Accumulated).

Research shows that many subjects show significant signs of recovery from a full Marathon (42.2 KM, 26.2 Miles) after a week; most show no signs of fatigue after four weeks, while some still show fatigue effects at ten weeks out. Since the AF Load (18.94) derives from a 100 Mile (160.93 KM, 3.82 Marathons) run, we will logically set the AF DFA initial value at the extreme amount of recovery time (70 days: 10 Weeks).

To determine the DFA of any load, we multiply the percentage of absolute fatigue by the AF DFA. The DFA from a Load can be understood simply as the amount of time it would take for the athlete to fully recover from the Load. The results are in table 3.

Activity	% Of Absolute Fatigue	DFA
Optimal Bench Press Activity	0.69%	0.48
Optimal Snatch Activity	0.79%	0.56
Optimal Powerlifting Squat Activity	1.22%	0.85
Moderate Workout	3.28%	2.30
Heavy Workout	4.29%	3.00
Modern Weightlifting Meet	6.40%	4.48
Historic Weightlifting Meet	9.74%	6.81
Powerlifting Meet	10.58%	7.41
Marathon	12.33%	8.63
Powerlifting Meet With Strict Curl	13.17%	9.22
100 Mile Run	100.00%	70.00

Table 3: Days of Fatigue Accumulated from various activities.

There are some exciting correspondences between the theoretical values in Table 3 and real-world training/competition praxis. As stated above, most athletes show minor fatigue effects after one-week post-marathon, and the DFA from a marathon comes to 8.63.

Most serious Powerlifters and coaches advise a week off after a meet, and the DFA for this activity is 7.41. Perhaps the most exciting synchronicity is that the research in "The Science Of Sports Training," by Thomas Kurz showed that any physiological ability recovered in 72 (3 days) after a heavy workout, and Table 3 shows that the DFA from a heavy workout load (3.74, established in the first paper) is 3.

These correspondences show that a rigorous logic is behind the method outlined here for determining the percentage of absolute fatigue from loads, the AF DFA, and finally, all DFAs.

5. Defining Fitness

The next factor required in the process of determining Preparedness is Fitness. I defined Fatigue as the sum of structural and vegetative degradations to the trainee's organism quantitatively represented by the Actual Internal Training Load.

Fitness (the short-term/transient aspect of Fitness, which is what we are concerned with in this paper) is essentially the amount of adaptative neural improvement (integration, firing rate, sequencing) from the load; and it is directly related to the work's intensity (percentage of maximum used). The concept is straightforward; the greater the average intensity of the work, the greater the neural adaptation from the work. The Fitness from a workout/session is then the Actual Internal Training Load (Fatigue) multiplied by the average intensity of the work.

Fitness = Load x Average Intensity

5.1 Calculating Average Intensity

To determine the Average Intensity of a workout, we must figure the average intensity of all the sets. For this, we use the Abstract Internal Load. Using the Abstract Load rather than simple "reps" of a set provides a more accurate average intensity assessment.

To start, we determine the Abstract Load Points of a set by dividing the Abstract Load by 0.01. We then multiply the Load Points by the intensity of the set. To determine the average intensity of an entire activity (Bench Press, Snatch, Powerlifting Squat, etc.), we sum all the sets' load points and divide it by the sum of all the load points * intensity values.

We then apply the Spatial Form Stress Factor to determine the Actual Internal Training Load (Fatigue) and Fitness from the activity. Table 4 shows the results from an optimal load Bench Press Activity done with 80% intensity.

Sets		Intensity	Reps	Abstract Load	Points	Points * Intensity
Type	Number					
Warmup	1	40.00	6	0.07	7.00	2.80
Warmup	2	48.00	4	0.05	5.00	2.40
Warmup	3	56.00	2	0.03	3.00	1.68
Warmup	4	64.00	2	0.04	4.00	2.56
Warmup	5	72.00	1	0.03	3.00	2.16
Main	1	80.000	4	0.18	18.00	14.40
Main	2	80.000	4	0.18	18.00	14.40
Main	3	80.00	4	0.18	18.00	14.40
Main	4	80.00	4	0.18	18.00	14.40
			Sums	0.94	94.00	69.20
				Average Intensity	74%	
				Stress Factor	0.8	
				Fitness	0.55	
				Fatigue	0.75	

Table 4: Average Intensity and Fitness and Fatigue values for a Bench Press activity.

5.2 Days Of Fitness Accumulated: DFA to DFiA Ratio

Just as we needed a "Days of Fatigue Accumulated" for Fatigue, we require a reciprocal time to total decay for Fitness. We will call this value "Days of Fitness Accumulated" (DFiA).

The two-factor (Fitness/Fatigue) theory states that though the amount of fatigue accumulated from a session is greater in magnitude than Fitness, the fitness gain *lasts longer*; this is why training is effective over time.

In the "Science and Practice of Strength Training," Vladimir Zatiziorsky states that the fitness gain from a moderately sized session lasts approximately three times as long as the fatigue effect. This practical wisdom is in the mind of most strength coaches during the planning phase of a training program.

Naturally, the farther a load is (greater than) from moderate, the farther it moves from the moderate load Fitness-Fatigue time (DFiA-DFA) ratio (3). The ratio would reach the least advantageous value with an Absolute Fatigue Load value (18.94). As the LQ decreases, the DFiA-DFA ratio would increase exponentially from the ratio of the AFLV ratio.

We will use a similar system to the one used to determine DFA, utilizing the percentage of Absolute Fatigue value to determine the Fitness-Fatigue time ratio. The following equation provides a logical value:

(AF Ratio*(1 - Load% AF Load)) + AF Ratio

This equation increases the DFiA-DFA ratio exponentially from the AF ratio according to the percentage the given LQ is of AFLV. To determine the DFiA we multiply the DFA by the DFiA-DFA ratio.

I attached a ratio of 1.53 to the 18.94 AF Load and discovered some interesting correspondences. The results are in Table 5.

Activity	Absolute Fatigue DFiA-DFA Time Ratio	DfiA-DFA Ratio	DFiA
Optimal Bench Press Activity	1.53	3.05	1.47
Optimal Snatch Activity	1.53	3.05	1.83
Optimal Powerlifting Squat Activity	1.53	3.04	2.74
Moderate Workout	1.53	3.01	6.92
Heavy Workout	1.53	2.99	8.98
Total Modern Weightlifting Meet Load	1.53	2.96	13.33
Total Historic Weightlifting Meet Load	1.53	2.91	19.80
Total Powerlifting Meet Load	1.53	2.90	21.45
Marathon	1.53	2.87	24.69
Total Powerlifting Meet w/ Strict Curl Load	1.53	2.86	26.30
100 Mile Run / 100% Fatigue	1.53	1.53	107.10

Table 5: Fitness-Fatigue Time Ratios and Days of Fitness Accumulated from Various Loads.

We find some interesting synchronicities between this system and real-world training/competition praxis in Table 5. First is the DFiA-DFA ratio of a 2.74 session load which falls right in the moderate/optimal session range established in the first paper). The ratio comes to 3, which precisely aligns with the logic from Zatziorsky stated above (Fitness from a normal-sized load lasts three times as long as the fatigue).

In "Managing The Training of Weightlifters," N.P. Laputin stated that competitive lifers should perform the last maximal load in training from between 13-and 15 days before a competition. In this context, we can deduce that a"maximal load" would be equivalent to a modern weightlifting meet (he published his work after the abolition of the Clean & Press from international competition). In that case, we can logically ascertain that the fitness from this load must last from 13-15 days. In table 10, we see that the DFiA from a modern weightlifting meet load is 13.33, a fascinating synchronicity.

6. Preparedness

Now that we have defined the process for determining Fitness and Fatigue values and the amounts of time to complete decay of both (from a training activity, session, or competition), we can now get to the performance factor we are finally interested in: Preparedness.

Preparedness is the balance of Fitness and Fatigue at any given moment in the training process. Essentially, the equation looks like this-

(Accumulated Preparedness + Current Fitness) - Current Fatigue = Current Preparedness.

To take this concept from the abstract to the actual realm, we must expand the equation by inserting our Fitness and Fatigue values, the DFiA, DFA, the rates of decay of both, and a time quantity, which is the number of days since the end of the training session.

The Fitness gain and Fatigue accumulated from a session decrease exponentially from the instant an athlete finishes a session all the way to zero at the expiration of DFiA and DFA, respectively. For the equation to work correctly, it is necessary to convert DFiA and DFA to hours, so we will use HFiA (Hours of Fitness Accumulate) and HFA (Hours Fatigue Accumulated) instead.

The following equation describes the decay of the Fitness gain following a session-

Fitness Gain*(((H0^((((HFiA-HC)/HFiA)*Log(HFiA,H0))-H0)/HFiA)))
= Current Fitness

Where-

H0: Hour Zero, or the moment of cessation of the session
HFiA: Hours of Fitness Accumulated
HC: Current Hour, or the number of hours since the cessation of the session

In this equation, the Fitness Gain is the multiplicand, and the multiplier is the percentage of remaining fitness.

We use the same process to determine the current Fatigue at the same current hour-

Fatigue Accumulated*(((H0^((((HFA-HC)/HFA)*Log(HFA,H0))-H0)/HFA))) = Current Fatigue

We also add any initial preparedness (Pi, developed from previous sessions) present at the beginning of the session to arrive at the actual current preparedness. The whole equation is then-

Pi + Fitness Gain*(((H0^((((HFiA-HC)/HFiA)*Log(HFiA,H0))-H0)/HFiA))) - Fatigue Accumulated*(((H0^((((HFA-HC)/HFA)*Log(HFA,H0))-H0)/HFA))) = Current Preparedness

To display the practical application of the equation, we will take the example of an athlete who has rested 60 hours after a heavy workout Load (3.74) that had an average intensity of 80%, with an initial preparedness of 1.54 at the start of the session.

The values from that Load are-

Initial Preparedness: 1.54
Average Intensity: 80%
Actual Training Load: 3.74
Fitness Gain: 2.99
Fatigue Accumulated: 3.74
DFiA, HFiA: 8.9, 214.6
DFA, HFA: 3.0, 72.0
Current Hour: 60

With the actual values plugged in, the equation is-

1.54 + 2.99*(((1.001^((((214.6-60)/214.6)*Log(214.6,1.001))-1.001)/214.6))) - 3.74*(((1.001^((((72-60)/72)*Log(72,1.001))-1.001)/72))) = 1.56

The Current Preparedness of the athlete at that moment is **1.56.** This equation allows us to place actual values into the theoretical two-factor theory model in figure 1. The "Workout" in figure 1 is equivalent to the Load. We can repeat the figure on the timeline for all the workouts in an athlete's program to determine what the exact Current Preparedness will be at any given moment in the training-competition process. For coaches, this is the ultimate birds-eye view of an athlete's preparation process, and it constitutes a revolutionary innovation in the art of "peaking" athletes for competition.

When designing a training program, the goal of a coach/trainer should be to arrange the loads and average intensities to drive the athlete's current preparedness as high as possible at the moment of an important competition. A Fatigue value of zero at the exact moment would be optimal.

7. **Autoregulation of AF DFA and Fitness-Fatigue Ratio**

The system of equations for practically determining preparedness at any given moment in the training process is now nearly complete. There is only one more process required for total optimization.

We established the logical initial amounts for Absolute Fatigue Days of Fatigue Accumulated and Absolute Fatigue Days of Fitness-Days of Fatigue Accumulated ratio. The logic for these amounts based on the correspondences from real-world praxis and other experts' research makes these amounts sufficient for starting the process with any athlete. However, recovery ability varies for every athlete and improves as part of the long-term training effect. For this reason, the Absolute Fatigue Days of Fatigue Accumulated and Absolute Fatigue Days of Fitness Accumulated-Days of Fatigue Accumulated ratios must be dynamic.

A periodic autoregulation protocol based on a basic performance test is best to optimize the variables for each athlete. The athlete should perform a fitness test with low-intensity exercises that represent his/her power-output potential (over-head soccer-style medicine ball throw and standing or one-step vertical jump, for example) when they are totally fresh before beginning the process; the results represent the athlete's long-term/stable ability according to the current stage of development. The coach/system will store the results to use as a reference for regulating the AF DFA and AF DFiA-DFA ratio variables. The coach should administer the same test periodically and compare the results with the expected results in relation to the percentage of fatigue present according to the Fitness-Fatigue-Preparedness calculations.

When the test occurs, a certain percentage of Absolute Fatigue will be present according to the size of the previous load(s) and the amount of time that has passed since the end of the previous workout. We would expect the test results to be off by this percentage; in this case, the AF DFA and AF DFiA-DFA ratio will stay the same. If the results are off by more than this percentage, the coach should increase the AF DFA and decrease the AF DFiA-DFA ratio. Conversely, if the athlete overperforms, the coach should decrease AF DFA and increase the AF DFiA-DFA ratio.

An example of the entire process is as follows- before beginning a new training cycle, when the athlete is fresh, he/she performs three overhead soccer-style medicine ball throws and three vertical jumps after a warm-up. The coach or athlete records and saves the best result of each exercise. A hypothetical example of this test is in table 6.

Attempt	Medicine Ball Throw	Vertical Jump
1	3.2	1.1
2	3	1
3	3.3	1.2
Result	**3.3**	**1.2**

Table 6: A hypothetical Initial Fitness Test.

During the training cycle, the coach administers the test again after a warm-up at the beginning of a session. For this example, we will suppose the test occurs at the same moment in the training process as the above example from section 6, sixty hours after a training session with a 3.74 load.

A 3.74 load develops 4.27% of Absolute Fatigue, which is present right when the session ends. To determine the percentage of Absolute Fatigue present after 60 hours of rest, we use the current fatigue equation from section 6. But here, we place the percentage of Absolute Fatigue at the beginning of the equation rather than the fatigue value.

% AF Accumulated*(((H0^((((HFA-HC)/HFA)*Log(HFA,H0))-H0)/HFA))) = Current % of Absolute Fatigue

With this equation, we see that the percentage of AF present after 60 hours is 0.12%. We expect the new test results to be about the same as the initial test since the fatigue present is less than 1%.

Suppose the new test results are those in table 7. In this case, the athlete's results improved, so their preparedness is higher than would have been predicted. To autoregulate the variables for further optimization, we will need to decrease the AF DFA and increase the AF DFiA-DFA ratio by the percentage of improvement.

Attempt	Medicine Ball Throw	Vertical Jump
1	3.3	1.3
2	3.3	1.2
3	3.5	1.3
Result	**3.5**	**1.3**

Table 7: A hypothetical new fitness test.

The medicine ball throw and vertical jump improved by 6.6% and 8.3%, respectively. We will alter the variable by the average of these values.

The following equation changes the Absolute Fatigue Days of Fatigue Accumulated variable correctly-

((-(AVERAGE(R1:R2)+%AF))*AFDFA)+AFDFA = New AFDFA

Where-
R1: Result 1 (Med. Ball Throw change %)
R2: Result 2 (Vert. Jump change %)
%AF: Percentage of Absolute Fatigue at the time of the test
AF DFA: Previous Absolute Fatigue DFA

With this equation, the altered AF DFA accumulated goes from the previous 70 down to 64.9. The DFA from the workout with the 3.74 load goes from 3.0 down to 2.8.

This equation alters the Absolute Fatigue Days of Fitness Accumulated-Days of Fatigue Accumulated Ratio variable correctly-

=(((AVERAGE(R1:R2)+%AF))*AFFiFaR)+AFFiFaR

Where-
R1: Result 1 (Med. Ball Throw change %)
R2: Result 2 (Vert. Jump change %)
%AF: Percentage of Absolute Fatigue at the time of the test
AFFiFaR: Previous AF DFiA-DFA Ratio

This equation alters the AF DFiA-DFA ratio from the previous 1.53 up to 1.64 and the 3.74 load ratio from 2.99 up to 3.21.

These new figures bring the Current Preparedness at 60 hours after the 80% intensity-3.74 load-1.54 Initial Preparedness from 1.56 up to 1.58.

If the test results had shown a decrease in performance, the same equations would have increased the DFA and decreased the DFiA-DFA ratio accordingly.

The changes in these variables can be very minimal, but over a long period of time, they are necessary to optimally peak an athlete's preparedness. In elite competition, the difference between winning and losing is usually minimal.

According to the athlete's specific sport and the coach's determination of the most relevant abilities, the coach can expand the test exercises or change them accordingly. The coach can choose activities to test other abilities/skills, such as reaction time. The possibilities are endless and depend only on the coach's expertise and creativity.

8. Summary

In this work, I provided the reader with an overview of the classic two-factor/Fitness-Fatigue theory training model. This model is and has been the theoretical basis for all training programming for elite athletes for decades.

I provided logical processes for determining practical values for Fitness and Fatigue from various loads. I also provided a logic for determining the amount of total decay time of both.

After determining Fitness and Fatigue values and decay rates/times, I provided the process for determining the primary short-term determinant of performance: Preparedness.

To ensure the optimization of the Preparedness process for any athlete, I provided a rigorous protocol for autoregulating the relevant variables continually across time.

9. Conclusion

The two-factor training theory is the fundamental concept of serious trainers' professional education. The two-factor idea is always in the mind's background when a strength & conditioning coach is designing a training program. As a mental model, it proved long ago to be much more helpful than the single factor/supercompensation theory, and adoption of it immediately improves the accuracy of training prescription and results.

However, up until now, it has remained generally abstract. Intelligent trainers and coaches have intuitively grasped the theory's validity, but precise practical application in the training process has remained elusive.

In this paper, I synthesized several years of research and contemplation of other experts' work. I took the two-factor theory from the abstract realm and made it imminently practical for serious coaches and trainers.

A real-time value for Current Preparedness is essentially the Holy Grail of elite athletic preparation. The possibilities that will open up when the equations and processes provided combine with the creativity and expertise of Strength & Conditioning coaches are extraordinary and limitless.

The combination of the system provided here, and the ingenuity of coaches from various disciplines will make physical training science not only more precise and methodical but also more exciting and engaging.

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