Transitioning from TSC to Feedback Statics

Version 3.0

by
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[A glossary of technical terms is listed at the end of this treatise.]

With this updated treatise we have reconfigured Ken Hutchins' 30-year-old *Assumed versus Real Objective Argument* to encompass new thought and understanding. This is another example of how SuperStatics philosophy and practice facilitates reflection and reevaluation.

We hope that this evolution will provide greater clarity for you and your subjects. A comprehensive glossary of new and past technical terms is listed at the end of this treatise to assist with its comprehension. Please consult it liberally when you encounter terms unfamiliar to you, or terms that may have been assigned inaccurate meanings.

Part I—Contributed by Ken Hutchins

Determining Target Load

If, for the first time, you are about to use a static apparatus that offers some kind of feedback, the first natural question is: "What should my target load be?" or "What should the target load be for my subject?"

If you have been doing or instructing Timed Static Contraction (TSC) for a while, you already have the tool with which to determine your target load for any exercise applied with a feedback device.

In fact, you may decide that TSC is better than the Feedback Statics (or *FS)* for some subjects. I have several customers buying my SuperStatics equipment who are so sold on TSC that they believe that FS is just begging for problems in terms of the *assumed process* (demonstrating strength by producing maximal force or sustaining a target load, promoting *outroading* behaviors) and the *mistaken objective* (injury, enhanced and impractical skill confused for strength gain, wasted time, poor inroading with no stimulus, overtraining). They would never consider putting feedback capability on my products, although I have built it to accommodate load cells and displays. And I greatly appreciate their point.

If, however, you learn how to properly apply FS in a manner consistent with the *real process* and the *desired objective,* then you can enhance the performance and the effects of static exercise, as well as reap the benefits of measurement. FS is an adjunct to TSC, not its replacement.

Whenever TSC is mentioned, it is a given that the exercise is to be staged. *Staged* means that the exercise is performed in stages or levels or steps. *Staged* does not mean that it is pretended. (This also explains how we are still able to retain the nomenclature of a set of an exercise in TSC. In dynamic exercise, it is a set of repetitions; in static, a set of stages.) All of this is laid out in *The Renaissance of Exercise—Volume I* (ROE-I) available from *baye.com.* It is also explained, and further expanded upon in *Music and Dance—Critical Factors for Practice and Conditioning.* (also named *Critical Factors for Practice and Conditioning.)* This article assumes that the reader already has mastered these prerequisites.

The expedient solution to arrive at a target load for performing FS is:

> Perform the exercise in TSC mode and with the feedback system operating but with the subject blinded from seeing and knowing

the force measurement readout. Obtain the subject's force values for stages 1, 2, and 3.

On the next bout* (workout session), discontinue the staging (TSC) and instruct the subject to load to the stage 2 value, while using FS for the duration of the bout. (*A *bout* is a distinct exposure to meaningful time under load. See glossary for more detail.)

This recommendation, to start the subject's target load in FS with the value of the second stage, is conservative. And for many subjects, this is the ideal approach. If a subject performs his next bout with an appropriate *time at target*, or *TAT* using this selected second-stage value, then you may decide to progress the subject to a higher target load for his next bout.

If, however, the subject is unable to perform with an appropriate TAT, you should retrogress the subject by reducing the target load at the next bout.

Retrogression is the opposite of progression, but unlike progression, retrogression is context driven. In one context it applies to the subject (a subject who loses strength and conditioning retrogresses).

In its other context, it applies to the instructor. In the case above, of a subject unable to perform with an appropriate TAT at his first FS bout, retrogression by the instructor is not a sign that the subject performed poorly or that he is weaker. It merely indicates that the target load is set too high to allow a *minimum time at target*, or *MTAT* with requisite controls (form). See glossary for more information.

Although somewhat discretionary, beginners should have longer minimum time at target, or MTAT (at least one minute), whereas most veteran subjects might have an MTAT of 30 seconds.

True, the immediately subsequent bout in this exercise might be more effective with a value approximately midway between the second and third stage values. And there are some situations where the third-stage value is the best place to begin. Leg press often qualifies for the third-stage value.

Let's closely analyze these wide-ranging recommendations.

Four Novice Presentations

First, consider a novice subject, especially one who has no experience with TSC. This subject has little self-awareness of his body. He has a poor concept of how strong or weak he is. He has not learned to engage his muscle efficiently. He has not become accustomed to physical feelings and how to interpret them. He does not know the feedback equipment, part of which is its sensitivity. And he lacks the skill to use it well. Do not assume that I'm necessarily referring here to a non-athlete.

In his first bout on FS wherein TSC is used to determine a starting target load, the novice may devote a *moderate effort* to the first stage that is way too high. In other words, he may shoot his wad on the first stage, show a less-than-expected increase going to his second stage and then show an unexpected decrease going to and continuing through his third stage.

You, his instructor, must silently consider several possible explanations. The first is that he did exactly as described in the previous paragraph.

The second thing that comes to the mind of a responsible instructor is the possibility of injury (worst case) or an encounter with pain.

At the end of the bout—if the subject has not already terminated the bout early—you must query him as to the possibility of any painful threshold. If the answer is "no" (we will discuss pain reports in a later article), then it is fine to merely ignore this and tag the middle value as a reasonable target load for his second bout occurring several days later. Once you observe his performance with this middle value, you will know more and will decide then whether to maintain, lower, or raise his target load.

A different presentation: The same novice—on a different exercise, perhaps—displays three somewhat evenly spaced values for his first, second, and third stages.

In many cases, the most conservative value to choose is the middle value. Although it is probably too low to choose as a target load for the subsequent bout, being somewhat too low is a good thing. Being a little low will facilitate the subject's mastery of controlling his trace.

Not immediately obvious, a subject is becoming more skilled as he progresses from showing moderate control to demonstrating perfect control with the same target load. And he is also stronger, especially during the first several sessions.

We must admit that skill acquisition in a feedback device (although meaningful at first) is nowhere as profound or as complex or as difficult to assess and account for as that in dynamic exercise.

Nevertheless, skill is definitely a factor even in a feedback static device. We are seeing a mixture of skill improvement as well as strength improvement within the increased numbers of the readout, particularly in the early stages of learning the exercise as performed on a feedback device.

A third novice presentation: This occurred with a new subject (11/24/2018). I supervised a 22-year-old ballerina in FS leg press for her first bout. In pounds (lbs), her three stages produced 42: 55: 110. I set her target load for this exercise at her next bout at 110.

Why so high? Why break my rule to use the second-stage value or to place the target load midway the second- and third-stage values? Is not it risky and unethical to set her target at her maximum strength level?

First, 110 is not her maximum strength. If she can sustain 110 for 30 seconds, it was not maximum.

Second, notice her output on the first stage. It's a pittance to be the output of a young, vibrant, athletic, 5' 9" woman. As a ballerina, she runs and jumps and lands around the dance floor.

She merely did not know how to engage the muscles during the leg press. My expectation was that during her second workout, she would require a protracted time to load to 110 and then sustain the load for a full two minutes (after I extended the display time). This then would indicate graduation (increase) of target load for this exercise for the third workout.

I could have been mistaken about this subject and about her capabilities in this exercise, but this is what experience with these tools often teaches us to expect in this particular scenario. My guess was that she would be using #200 by her sixth workout.

Within a dozen workouts she was performing over 300 lbs for FS leg press.

Bear in mind again: This woman is a ballerina. She does not aspire to be a ballerina. She *is* a ballerina—very determined, very disciplined, very focused, and very controlled.

Another scenario: I have a long-term subject (over 20 years with me off and on). She is now 70 (as of 2021) and has rods in her back (See photo next page.).

Static leg press is one of the few exercises she can perform. To ask her to perform dynamic leg press would be malpractice. (Her husband asked if it would be acceptable for her to ride a bicycle around their neighborhood in order "to get some cardio." I explained to him that if she took a spill, her spine would shatter like a Tinker-Toy model thrown against a wall.)

On her first static leg press bout she produced stage levels of 40, 60, and 100. Afterwards, she told me that she hurt during the exercise during the last stage. I immediately asked her if the pain had stopped when she terminated the exercise. Fortunately, it had stopped. This is a critical point to determine if the pain indicated harm.

Left: Posterior-anterior view of x-ray of woman with rods across several vertebrae.

Right: Same subject's left lateral view. Weird shadows are from foliage seen through a kitchen window on which the films were placed in absence of a light box.

I then scolded her for producing a force so high that pain ensued. Although I had explained to her not to push beyond a pain threshold—even a mere cusp or faint edge of a sensation that she suspects might become painful—she had wanted to try her best. I made her promise me not to do that again.

On her second bout with static leg press, she followed my rules precisely and managed to sustain 80 pain-free throughout the full two-minute bout. With hip ADduction and ABduction added in for the Leg Press Triad, we remained at this level for another workout or two to test her body's reaction, then dared to progress by 2.5 lbs per month for several months. She now regularly performs at 100 although her target is 110. Unrelated knee issues have temporarily stunted and reversed our progress somewhat.

What makes her progress more impressive to appreciate is that her current performances on static leg press are now (unlike the introductory bout) always preceded by static hip ADduction and ABduction. The leg press is most immediately preceded with static hip ABduction for pre-exhaustion purposes in what we denote the *Leg Press Triad*.

Note that although I might have reduced her force generation during her first bout doing leg press *after* pre-exhaustion with static AD and AB, their inclusion would then have confused any painful issues so that I would have been unable to distinguish the origin of any irritation. Such pre-exhaustion did reduce the forces that seemed to be irritating her knees during the leg press.

Often, I must temper my enthusiasm to help a back condition by trying multiple machines/ movements involving Rotary Torso, Trunk Extension, Linear Spine Flexion, etc. If I apply one approach and get success, I stop. If I continue to throw my entire proverbial toolbox at the problem and the condition returns within the following three days, I won't know what to blame it on.

Some of the foregoing Part I, though composed by Ken Hutchins, was the result of many discussions between Ken and Gus over the past 10 years.

Part II—Contributed by Gus Diamantopoulos

Winging It

With a novice subject it is often tempting to merely guess the target load in FS and to dispense with the blind TSC protocol described in Part I. I have been guilty of this at times and I’m sure that many instructors have been *winging it* in much the same way.

But with the breadth of feedback systems in my facility, and more recently in my development of the PUSH machines, I have learned that guessing is a haphazard approach that may even interfere with optimal progression. (See photos next two pages.)

You might sometimes guess target load correctly, and this can be satisfying. But if you guess a target that is too low, you may waste a number of sessions before a subject can experience appropriately demanding workouts.

PUSH machines by Gus Diamantopoulos

These truly portable static exercise devices provide digital feedback to both user and instructor. They require no additional floor space and when not in use merely hang on the wall as they are recharging.

Upper Previous Page: The iADAB is a 2-fer in providing exercise for both hip ADduction and ABduction. It can be applied as illustrated or while seated on the RenEx or SuperSlow Leg Press machines to perform buttocks pre-exhaustion for leg press exercise without the need of wasting precious time transitioning the subject between major machines.

Lower Previous Page: The iLR is the ideal way to perform a lateral abduction (lateral raise) exercise for the shoulders.

This Page: The iPec can be applied with the shoulders either internally or externally (shown) rotated. Similar to using the iADAB immediately preceding leg press, the iPec is most effectively used for pre-exhausting the chest musculature immediately preceding chest press by seating the subject in a chest press device, thus eliminating the need to move between major machines.

Winging It continued from Page 8.
This can have far-reaching implications if that subject learns to work with insufficient effort. This is akin to selecting too low a weight in dynamic exercise. By the time the weights are appropriate, you've lost many weeks and worse, the subject now has a recalcitrant attitude to inroading.

By contrast, if you guess at a target that is too high, the subject is likely to compensate with outroading behaviors that are very difficult to correct and will require retrogression.

A very weak subject's initial attempt at performing TSC for FS posterior neck. Her stages are not distinctly graduated. Also, her third stage is lower that the first two stages indicating that she exerted too much effort on those first two stages. With experience, she will acquire the skill to manage this much better.

Blind TSC, Literally:

For the initial bout of staged TSC used to determine target load for FS, the subject must not be able to see the feedback displayed on force gauge or the computer monitor as he performs the exercise.

However, the instructor must be able to view the feedback during the exercise performance for the purpose of assessing the stages. Some of the feedback systems' displays can be withdrawn from the view of the subject by rotating the screens' arms. But with other equipment, the feedback display cannot easily be moved or hidden from the view of the subject.

In this case, the ideal solution is a blindfold.

Although it may seem like a Luddite approach, a simple blindfold is effective, universal, and it may even promote better performance of TSC by reducing distractions, helping the subject to focus. It is a well-established phenomenon that when one of the senses is occluded, other senses compensate. In this case, it is the senses relating to muscle engagement and contraction that become enhanced when the subject is blindfolded.

Stages Subsumed

TSC generally requires the subject to produce three distinct stages of effort. In practice, after a subject has been inculcated in FS, the trace of a well-performed set of these stages is relatively flat (until a high enough intensity presents a sloping trace, thus indicating inroading below the target. More on this later).

In contrast, when a novice is first introduced to TSC it is common to see a force trace that increases stepwise in concert with his effort level. That is, each stage of effort is displayed as a distinct stage of force output.

It is from these force-measured stages that an instructor will often select the middle value to determine the succeeding target load.

On some rare occasions, however, a subject may perform the stages so well that his force trace subsumes the stages. Such a force trace may be relatively flat and stable from the first deciding TSC bout, despite having no visual feedback to benchmark his TSC staged effort. We might consider such a subject to be a *natural*.

A natural: The novice who may be an expert. Consider the recent case of a novice subject who was introduced to TSC and FS exercise for his upper body exercises because of a shoulder injury. [Note that compound row is expectedly the most unoffending shoulder exercise for anyone, especially a subject with shoulder issues, because the upper arm is held close to the lateral torso, almost that same position almost always used to immobilize and to protect the shoulder with a

The RenEx iMulti used for static compound row exercise.

sling and swath after injury or surgery.]

On his first attempt at TSC compound row he produced a practically flat trace on the graph, at about 90 lbs of force. Moreover, this trace was impressively stable, and his ramp to 90 lbs occurred in 10 seconds.

Realize that this subject had never done TSC or static exercise before, and yet he demonstrated a trace that well-subsumed the three stages of effort (a blending of force and effort). In stage 1 he appropriately attained his *moderate effort*, which produced 90 lbs of force.

Initially, I thought this was too much force for the first stage, and I worried that his force output would decrease precipitously. But I was wrong, because in stage 2 he was clearly able to sustain that force level.

At 60 seconds, stage 3, I incited him to gradually pull *"as hard as you dare."* Weakened by the previous two stages, his now greatest effort did not produce an increase in force. But there was also no force decrement. The force value remained at 90 lbs. Realize that at this stage he required significantly greater *effort* to sustain his 90 lbs of force.

Remember, this subject had no visual feedback to reference for his force output. He was merely following my TSC instructions and applying his perceived requisite effort at each stage.

I was incredulous to observe such a performance from a subject's first attempt at TSC. I am not surprised that I've not seen the likes of this, since. Perhaps one day there will be another…

Different, But Same

The real process of an exercise is to momentarily fatigue the musculature by inroading it as safely, quickly, efficiently, and deeply as possible for the desired objective of stimulating the muscular growth mechanism with the least magnitude of load in the least amount of time.

In many ways, TSC exercise is the apotheosis of the real process and the desired objective, because it completely obviates the quantitative aspect of load. With TSC, we cannot know the magnitude of load. There is no viewable measurement of it, and there is no repetition or pattern of movement to complete like in dynamic exercise. The only known external, independent variable is *time*.

We might consider TSC exercise, therefore, to be internally mediated. An instructor can referee discrepancies and may be able to detect feigning to some small degree, but no instructor or subject can reliably estimate force values in TSC. And although it is not necessary to know these values when it comes to meaningful work relative to the real process and the desired objective, it becomes challenging to scale progress over time, which can impede motivation—and possibly compliance—to a long-term exercise program.

[One important benefit of TSC is the ability to precisely manage the slightest presence (or suspicion) of pain. How to teach TSC to novices (and the necessary graphics for teaching this) so that a pain threshold is safely dodged is presented in *Music and Dance—Critical Factors of Practice and Conditioning* (also titled, *Critical Factors of Practice and Conditioning*) by Ken Hutchins.]

This is why we have created Feedback Statics (FS).

We acknowledge that we are—by our nature—achievement oriented as a species. And exercise is by no means exempt from our predilection for measurement and quantification. FS exercise facilitates the ability of the subject and the instructor to not only perform static exercise with precision, but to also enhance our ability to make incremental progressions over time, to effectively explore the treatment of injuries and debilities below pain thresholds, and to promote higher levels of mastery of any given exercise.

I tell my subjects that their static workouts are a blend of high-tech and low-tech. It's good to have force measurement feedback, but it is not necessary. In fact, most advanced subjects develop a unique pattern of periodic attention to the feedback display that is somewhat akin to the way a driver observes the instrument panel in a car.

The speedometer in an automobile is an accurate indicator of your vehicle's speed. And it is important to be aware of your speed. But if you stare entirely at the speedometer while driving you are guaranteed to crash. While driving, your primary concern is the road and where you are going.

Similarly, in FS, the feedback system is a tool to effectively achieve the target load. But your primary concern is to engage the target musculature with your effort and to inroad it effectively and efficiently.

A subject who is performing well in FS is applying a TSC mindset within a FS environment. Such a subject is more concerned with progressive effort and engagement of the target musculature rather than keeping a trace flat or chasing numbers on a force gauge. Used in this way, FS can help us to enhance our achievement of the desired objective.

The novelty and effectiveness of any feedback system is no substitute for the real process and, therefore, the desired objective of exercise. Always focus first on engaging the target muscles during the exercise, rather than on the target load or other external variables.

Note: Since we never can know the exact depth of inroad to achieve the stimulus, we inroad as deeply and quickly as safely possible. We are therefore tempted to think that the desired objective is synonymous with the real process.

Recently a subject said to me:

> "I think the reason you want me to experience muscular failure is to stimulate my growth mechanism. But what if my threshold for stimulation is less [more shallow] than failure?"

I answered:

> "You may be right. And the reason we seek the attainment of muscle failure is because it is the only semblance of certainty for stimulation we have in the spectrum of intensity. We have 0% effort, which is rest, and 100 % which is failure. By going to failure, we cover the break-over points, whatever they may be."
>
> [Note that the stimulus point might actually move. See *inroad* in Glossary.]

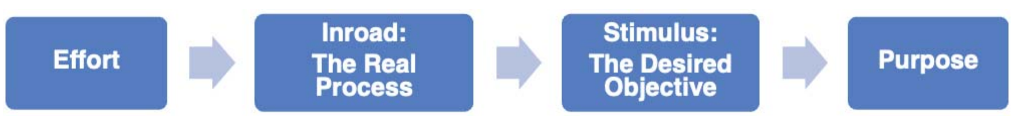
In the hierarchy of exercise values, it all begins with *effort.* Effort generates *inroading.* And inroading is the *real process* or the means by which we get to the *stimulus.* The stimulus is the *desired objective* of exercise. By focusing on the real process and the desired objective, we serve the *purpose* of exercise, which is to produce benefits to your body so that you can improve the quality of your life.

Important Concepts For This Section:

The real process of an exercise is to momentarily fatigue the musculature...Inroad.

In many ways, TSC exercise is the apotheosis of the real process, and therefore, the desired objective...

We might consider TSC exercise... to be internally mediated.



Feedback Statics 101

PUSH devices and some RenEx/ SuperSlow Systems machines possess either optional or integrated force measurement feedback systems.

Equipment with these systems measures force using load cells, or *sensors.* Some apparatuses use one sensor, while others may have multiple sensors used in concert or independently.

Regardless of configuration or quantity, the sensors convert tension and/ or compression forces into an electrical signal read by a *force gauge* that then provides an instant digital reading of the forces applied to the apparatus.

We use *apparatus* to indicate all exercise devices and machines, and we distinguish between *machines* and *devices.* An exercise machine is a complete exercise mechanism or apparatus—meaning that it provides a seat and an obstacle (handles, foot board, movement arms, etc.) to exert against.

A device is incomplete. It may provide an obstacle to exert against but not a seat. To use a device, the subject is required to furnish a support on which to sit or lie. A device must never be used while standing, despite the widespread marketing of exercise devices that displays otherwise.

In some apparatuses, the force gauge provides the final measurement reading as a digital value. In other machines, the force gauge is connected to a computer with a software program that captures and displays the data to the user in a graphical, analog format for *load versus time*, whereby you can see both instantaneously current information as well as a history of your performance, from the beginning of the exercise. This graphical history, optionally, can be saved and printed for comparative analysis.

[Note that all feedback begins with the digital source, whether it is a digital-feedback-only system or an analog-graphical system.]

Any apparatus that possesses both feedback systems may be used with the computer's analog software only—with the computer and the force gauge—OR with only the digital feedback from the force gauge—without the computer and the computer software's analog display.

For example, the computer's display may be used by the working subject while the force gauge is observed by the instructor. Or a particular machine may be purchased with only the force gauge to save on the expense of a computer. Or as is the case with wireless and portable PUSH machines, the device may only ever provide digital feedback from the integrated force gauge.

Although effective and useful, a digital-only measurement does not provide a history of the subject's performance, nor can the performance be saved or printed. In other words, you can only view your instant force production, not a graph showing your performance leading up to the present.

To provide accurate and meaningful feedback to the user, the system—whether digital-only or analog—must be manually calibrated by a procedure called *taring.*

Taring sets the gauge to zero. Taring the gauge is necessary for proper use of an apparatus if used for FS. Without taring, you cannot acquire a reliable measurement during exercise.

Taring may be necessary to cancel bodytorque, to cancel stored energy, to calibrate the gauge, or to compensate for a machine's movement arm torque. Each individual apparatus has its own special procedure and requirements for taring. See instructionals/ or practical scripts for details.

Introduction to analog graphic feedback:

Consider a RenEx iMulti machine with its integrated feedback system. The computer screen displays a graph. On its Y-axis is Force and on its X-axis is Time.

Time is the independent variable (displayed in seconds).

Force is one of our dependent variables (typically displayed in pounds). It is the dependent variable that we can measure and the key variable that a subject can manipulate in his performance of any exercise.

Force is the result of your *exerting* (tension or compression) upon the apparatus parts resulting from the interaction between the subject and the machine.

However, force is merely the external and viewable variable. The truly important dependent variable, as we have already asserted, is effort. Effort is internal, subjective, and invisible to any force gauge or software.

For our purposes, effort is the vehicle of exercise intensity. *The percentage of momentary effort* exerted is how we define exercise intensity (also definable as *inroad/time).*

Effort is an expression of will. It is determination. But on an FS computer display or force gauge, effort is not shown as an observable variable.

Regardless of the fortitude or experience of any subject, never apply instantaneous, maximum force, as is commonly done in traditional isometrics. This is reckless and dangerous.

Above- and Below- Target Inroading (ATI and BTI) The key to transitioning from TSC to FS exercise is to acknowledge that force (load) and effort become inverse over time, and that fatiguing of the body begins to occur immediately upon loading. This is to say that *inroading* begins immediately upon loading.

If, for example, you gradually ramp to a target load of 100 lbs in 10 seconds and continue to steadily remain at target for the duration of the set (90 seconds), your effort must continue to increase. If you maintain 100 lbs at completion, you produce a flat force trace that subsumes the three stages of effort.

The above is an example of *ATI, or above-target inroading.* Only one of the two dependent variables (load) is constant. The other, (effort) is escalating. Focusing inappropriately on target load represents the assumed process leading to the mistaken objective of the exercise. Remember, effort, although not displayed or measured on the graph, is the dependent variable used to achieve inroad, and inroading is the process that gets us to the stimulus, which is the desired objective of exercise.

Now, let’s say that after ramping to the same target load of 100 lbs, you are unable to sustain the target load for the duration of the bout. At 60 seconds, for example, at the end of stage 2 your trace begins to slope downward slightly, meaning your force begins to decrease. If your effort increments in stage 3 to *“as hard as you dare,”* and your force capacity continues to dwindle, resulting in ongoing force decrement to the completion of the bout, this is called *BTI,* or *below-target inroading.*

ATI or BTI are the two grades that a subject can earn at the end of a bout, both of which constitute inroading, but distinguished by degree.

A flat force trace (or a stable value on a digital-only display) represents ATI. Some flat traces display a wide amplitude because of a subject's nervous inefficiency or because of equipment juddering. But if the trace bisects the amplitude's high and low values to correlate to the target load, the trace is considered to be flat. Whenever a subject produces a flat trace, the chart entry is ATI. On a subject's chart, ATI requires no associated load value, because the target load is the ATI value.

ATI generally means that the subject can be graduated to a higher target load. But this is not always the case. Especially in the learning phase of a subject's program, having more time to master the complexities associated with static exercise by repeating a target load can be beneficial. And, of course, never cross or crowd an injury or a pain threshold.

If, however, a subject's trace slopes downward to any degree (or if the value decreases on a digital-only display), then his force has decreased below his target load and is therefore denoted as BTI. Such force decrement can occur anytime during the set and to any possible degree. A shallow slope indicates gradual force decrement. A steeper slope indicates more precipitous force decrement. Charting BTI requires the inclusion of the decremented force value.

For example, a subject's target load is 100 lbs. He ramps to his target in 10 seconds and maintains his target load for one minute. Then his trace begins to slope downward as he inroads below target. At 75 seconds he can only generate 80 lbs of force. And at the conclusion of the bout (90 seconds) his decremented value is 75 lbs. This is charted as: Target Load 100 | BTI 75, and this would be an approximate 25% inroading from target, or 25% BTI.

Generally, BTI should not exceed 40%. 40% BTI in a 90-second FS exercise represents a high level of intensity. If a subject endures more than 50% BTI, then the target load is too high. At such extreme force decrement, BTI is also likely happening too soon and too precipitously, which also may also be injurious and cause numerous discrepancies.

To properly evaluate the performance of a subject who has experienced BTI, you must also consider when the subject experienced BTI, which informs the rate of his inroading.

To do this, you must examine his time at target, or TAT. TAT is the duration successfully maintained at the target load, excluding ramp time.

Referring back to our example above, the subject ramps in 10 seconds to a target load of 100 lbs and performs the exercise for one minute before he starts to display force loss. Thus, his TAT is 50 seconds. His BTI remains unchanged at 75 lbs at the end of the bout, but by registering TAT and BTI, the instructor has more information to appraise the subject's performance.

If, at the next bout, the subject repeats his performance with the same 100-lbs target load and with the same BTI of 75 lbs, but this time his TAT is 75 seconds, then the subject has increased his capacity to sustain the target load by 25 seconds. Without TAT, such improvement would not be declarable.

Similarly, to confirm that a target load or graduation is appropriate, you must account for the Minimum Time at Target load, or MTAT. If a subject can achieve a target load but can only perform for 25 seconds (excluding ramp time), then the target load is likely too high. MTAT is not a fixed value. A more advanced subject with ample experience can tolerate not only deeper inroading but may also experience such below target inroading earlier in the bout, or with a briefer MTAT.

The possibilities for the relationship between TAT, MTAT, and BTI between bouts are infinite, which is why it is important to consider more than just the target load and BTI when evaluating a subject's performance, particularly when considering graduation.

The take-home lessons are: ATI does not automatically mean that a subject should be graduated. The BTI value and percentage of a bout may not provide enough information to consider progressions, or lack thereof. And an awareness of TAT becomes increasingly more important as a subject becomes more advanced in FS.

Important Concepts For This Section:

Standardizing Force Generation

The truly important dependent variable, as we have already asserted, is effort. Effort is internal, subjective, and invisible.

... effort is the vehicle of exercise intensity.

Time is the independent variable.

Effort is an expression of will. It is determination. But on a FS computer display or force gauge, effort does not really exist.

Force is one of our dependent variables....

... inroad begins immediately upon loading.

... it is very easy to confuse force measurement with effort...

As stated earlier, instruct subjects to ramp to the target load in 5-10 seconds.

A ramping of three seconds or less constitutes what we term *spiking*. And spiking is usually combined with *overshooting*.

A spike is a sharp (or abrupt) generation of force. The more vertical the trace on the graph, the more sudden the force buildup.

Overshooting is the inadvertent exceeding of the target load. Most often a subject will spike at the beginning of a set and then undershoot before returning to the target a second later. This is called an overcorrecting reflex, or OCR.

A ramp of 10 seconds is commensurate with the *moderate effort* scheme of stage one in TSC and well within the confines of safety, as it provides ample time for the subject to register any potential approaching pain threshold and to react to it by lessening effort.

Longer ramping (up to 20 seconds) may be necessary for injured subjects or to manage pain, but for the most part, aim for 10 seconds.

Remember that target load is never the maximum force output that you can produce. Using TSC to determine target load, as we have described in this article, you can quickly (within a few sessions) get a novice to engage his target musculature and to experience the profound muscular stimulation that is possible in FS without requiring oppressive and dangerous target loads. He also has a better opportunity to practice how to effectively manage the demands of muscular discomfort and how to concentrate on the real objective.

A case of spiking. I have a long-time client who has learned to manage many of her orthopedic issues with proper exercise. Nearly her entire workout program is performed statically. However, despite her protocol literacy, she still has trouble with spiking and overshooting at the start of an exercise. This subject is notoriously jittery and performs all sorts of antics prior to most of her sets.

When she did TSC in the past (before the availability of FS), I knew that she was spiking, but without feedback there was no way to display this in a quantitative way. With the feedback system I can much better assess and correct her discrepancies.

In a recent bout on the static Leg Curl/Leg Extension machine (iLCLE), in the performance of static knee extension, I instructed her to ramp gradually to her target load of 125 lbs. Instead, she swung her lower legs abruptly against the movement arm, causing a spike to almost 175 lbs. Then, while holding her breath, she lurched forward and backward in the seat and erratically bucked her head. Her force plummeted to 80 lbs, followed by another spike to 150 lbs, and finally back to around 135 lbs, but with intense tremors in her legs and resonant juddering in the movement arm.

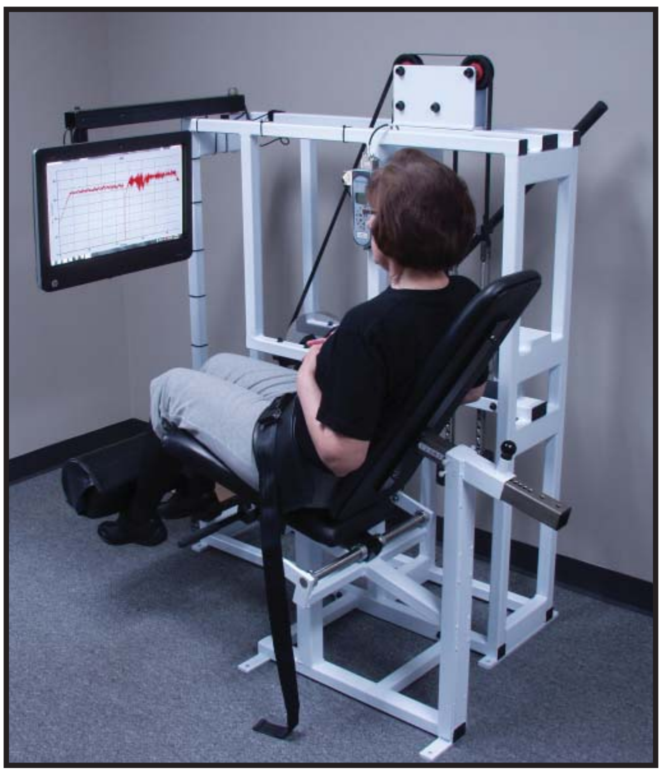
[Just imagine how difficult (actually impossible) this exercise—or any exercise—would be for this subject to safely attempt in a dynamic mode.]

This effect is common in some subjects with neurological challenges but can sometimes be corrected with static exercise and with proper instruction.

I reminded her of a *get-set* ritual that includes assuming the correct body attitude, being as still as possible before the commencement of the set, staying calm, and breathing.

Becoming physically motionless before starting an exercise is strangely difficult for many subjects. Anxiety, arousal, and tension can make such subjects twitch, wiggle, squirm, and/ or swing their limbs. Merely mentioning these behaviors is often enough to stop them, and it is important to do so as most subjects are completely unaware of their habits.

After adopting the get-set, her second bout showed more promise, with a trace that was more stable and with better breathing. Although she still experienced body tremors (some severe), she was able to avoid head-bucking and lurching this time. Most importantly, she was able to avoid



The RenEx iLCLE being applied to perform static leg extension exercise.

spiking and overshooting.

[Note that this subject routinely reports feeling opposing muscle groups during exercise. She feels her hamstrings during leg extension, latissimi during chest press, and triceps during compound row. However, when her discrepancies are managed as described above in the static leg extension exercise, she actually feels her frontal thighs engaging.]

False Ceilings:

A key challenge for many novices is learning how to accept the seemingly discouraging effects of BTI.

Earning ATI in a bout gives many subjects a feeling of success. A flat trace is rewarding and productive, but advancing to conservative BTI is more akin to having achieved muscular failure. I remind subjects that their success in the program is directly proportionate to their attainment of muscular failure, and that BTI is the best representation of failure in static exercise. Still, many subjects can become dispirited when their trace slopes downward to indicate even as little as a 10% BTI.

Some subjects will even refuse to strive for a higher target load when such progression is warranted, because they are fearful that they won't be able to sustain the target load, even if they do achieve it. This a clear regression to the assumed process and the mistaken objective.

When a subject produces a flat trace for one minute or longer (ATI), the instructor has the discretion to possibly increase the target load. This is the same concept as providing incremental weight in dynamic exercise in a double-progression scheme. In other words, when the subject can properly perform the number of repetitions at the prescribed upper range of reps for a given exercise, you should increase the weight for his next workout.

In dynamic exercise, a weight increase usually means that the number of repetitions may decrease in the next workout. Ideally, the number of fewer reps will be within the prescribed lower range of repetitions. Otherwise, the weight increase was too great.

For example, if a subject achieved 8 reps in a given exercise, and the prescribed repetition range is 4-8, you might consider adding 2% more weight. With the increased weight, it is possible that fewer than eight repetitions will be achieved (at least four are expected).

Similarly, in static exercise, when a trace is flat throughout the set (ATI), it may be prudent to progress the subject by increasing the target load at the next bout. Increasing the target load, however, may cause BTI to occur at that bout.

Progression must be curated carefully. Just as important as knowing when to increase target load is knowing when not to. In some exercises and sequences, the slightest increase in target load can result in radically increased perception of difficulty and intensity. Recall that being at ATI does not mean that the workout was not productive, nor does it mean that the workout was easy.

Furthermore, BTI being more intense does not always indicate that it is necessary or desirable to achieve BTI. There is value and benefit (particularly to special populations and to beginners) with bouts that purchase only ATI. Although the analog trace does not display the inroading that occurs before a subject becomes unable to hold a target, you can be sure that inroading was ongoing above the target.

In terms of the characteristics of a force trace, *steady* is more important than flat. Note that *steady* is not synonymous with *flat*. A flat trace may also be steady (ATI). But a flat trace may also be inconsistent and erratic. Or a steady trace may begin as flat only to eventually slope downward, but still remaining steady, thus indicating force decrement, or BTI. The latter is an expression of deep inroading and very intense exercise.

"I can't reach it." I have a novice subject who started FS exercise in October 2018. One of her greatest difficulties has been the iPOPD (static Pullover and Pulldown) (See photos.). In particular, she has always been challenged by the static pullover. The dorsal muscles used in the pullover are not easily engaged or felt by many women (and also some men). The necessary pelvic tilt is also a skill that requires practice.

On the static pullover load-determining TSC test set, her three stages produced 20 lbs: 30 lbs: high-30 lbs. So, I started her FS pullover at 30 lbs.

Six weeks later, she attained targets of 45 lbs (iPO) and 55 lbs (iPD) with flat traces (ATI) for both—target load maintained. This was the second time that she had achieved a flat trace that was also steady (narrow amplitude) for both sets.

At her subsequent session I planned to up her target load to 50 lbs. However, she complained that 50 lbs was too much and insisted that she could not reach the new target.

I explained to her that she likely meant that she might not be able to sustain the new target of 50 lbs for all 3 stages, but that she could absolutely achieve 50 lbs, if only for a short spell.

I reminded her about the real process and the desired objective, and I further elucidated on BTI:

> *Aim for 50 lbs for just the first stage: 30 seconds. It will be hard, but I think you can get there.*
>
> *If you fatigue to the degree that BTI is beginning to occur at stage 2, that's okay. Increase your effort to try to stay on 50 lbs. Maybe you can sustain your output through stage 2 and maybe you can't.*
>
> *When you actually can no longer sustain 50 lbs and force begins to ooze downward, that's when you'll be experiencing below-target inroading (BTI), and I want you to turn up your effort. The key is to not give up. Rather than letting the force drop abruptly, try to exert so that force only drops at a trickle. Perhaps you descend to the high 40s, then a few seconds later to the mid 40s, then a few seconds later to the low 40s, and so on. Control the rate at which your force dwindles.*
>
> *Continue to breathe and don't suddenly back off or give up.*
>
> *If BTI happens, think of your diminishing force as a slow leak rather than a blow-out.*

Continued on Page 31...

> *Keep exerting until time runs out.*

When she finally performed her static pullover set, she not only achieved 50 lbs but managed to sustain it for 75 seconds—half-way through stage 3. By 90 seconds she was down to about 40 lbs of force—a 25% BTI and her first experience with inroading below target on the static pullover.

The RenEx iPOPD

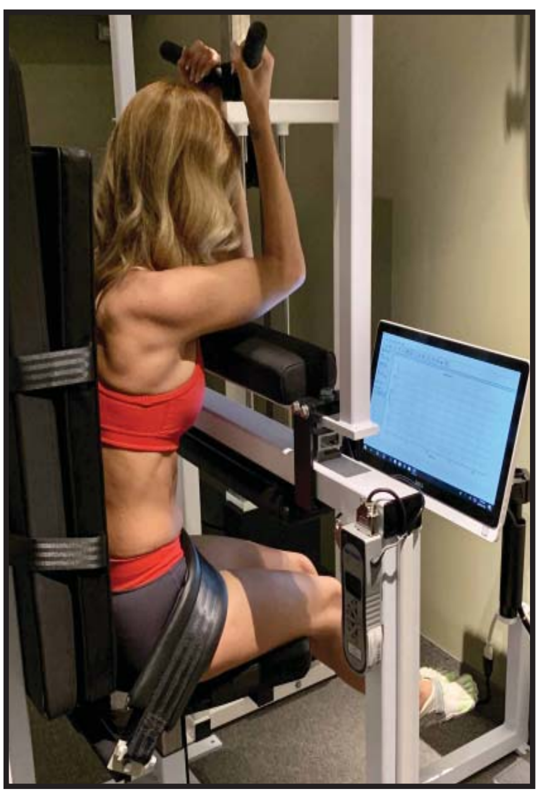
This Page:

Top Left: The subject first pre-exhausts the latissimus, chest, and abdominals performing static pullover...

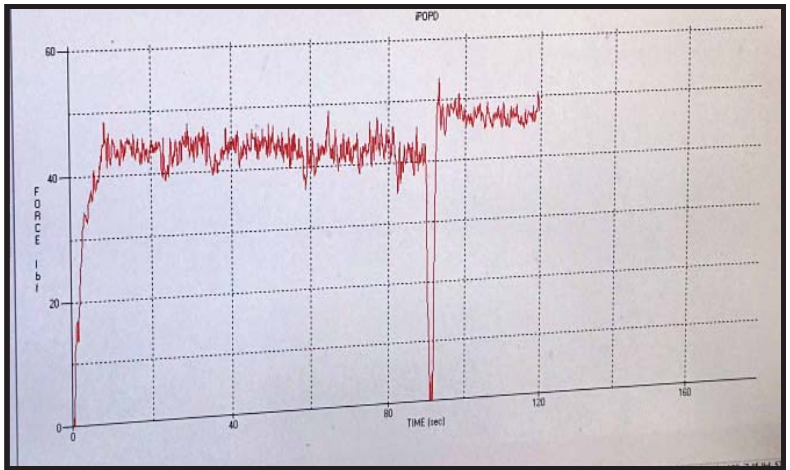
Bottom Left: ...then immediately transfers to the static pulldown to bring in the hands and arms to drive all the musculatures into deeper inroad.

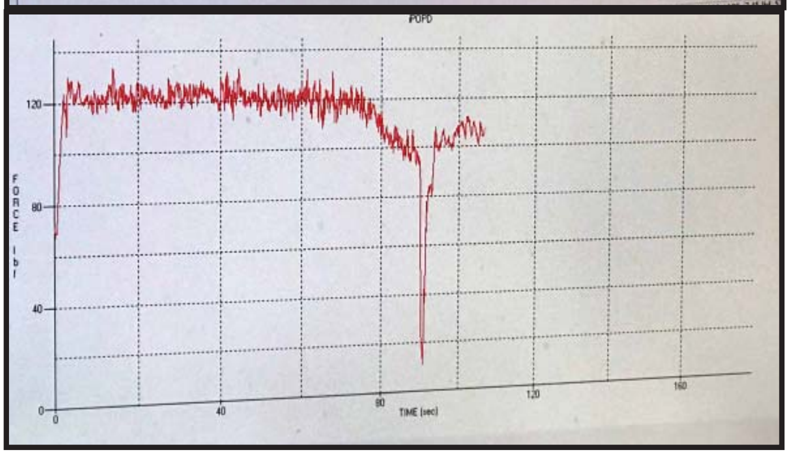
Next Page:

Upper: An intermediate subject ramps into the pullover, spiking somewhat, then overshooting. Note that her overshoot, however, does not exceed her occasional erratic control throughout the course of the exercise. It's acceptable only because her general control to produce a smooth trace is really no better. Assuming she holds her target of 42 (which she arguably did) and if we graduate her (increase the target load to 45), her control will be worse. If we stay the course with the present target load, her demonstration of improved control is subjective demonstration of being stronger.



Her transfer to the pulldown was admirably quick but too fast as it spiked and overshot. We expect more control on pulldown since it is a compound movement (Note her smaller amplitude here suggesting better control.), therefore the overshoot by this subject should be better





controlled, her naturally erratic output considered, of course.

It remains doubtful that, due to the effect of her ventilation, her amplitude for the pulldown can be expected to be much better.

Lower: Veteran alpha subject, John Daly, ramps to 120 lbs within 3 seconds (slightly too fast to prevent rebound) on static pullover, sustains for at target approximately 75 seconds, produces good inroad, then transfers and ramps to static pulldown within approximately 4 seconds with much better control at 105 lbs.

Also note that Ken pushed the start button for pullover slightly after John began loading toward the target as John's ramping begins at 70 lbs. Also note that Ken tares the iPOPD without inclusion of the arms.

Also note: Ken's iPOPD (from which the graphs were obtained) is an early version in which the required pelvic tilt introduces a negative value to the system which is controllably constant and acceptable when applied with the required instruction. Other RenEx iPOPDs (like the one pictured above) are designed to eliminate this variable.

[Note that a BTI of 25% is an overall inroading value of probably nearly 50%. We cannot quantify this, of course, but it is worthwhile to understand that the totality of inroading is greater than the measurable BTI value.]
When it was over, I couldn't tell if she was proud, frustrated or both. Regardless, I was keen to seize the moment and try to anchor in her mind that this performance was not only the best that she had done thus far in the program, but also that it must be what she always strives for when she exercises.

Summary

... think of your diminishing force as a slow leak rather than a blow-out.

All three subject experiences that I have reported are not unusual. They are fairly representative of what legitimate exercise instructors strive to convey to their clients daily. This is regardless of whether exercise is conducted in the dynamic or static mode.

Another Example from Ken

On November 11, 2018, I had a similar experience as Gus.

Dara is a client that I instructed at the Lincoln Fitness Center in the early 1990s. She recently resumed working with me this past September after a hiatus of about 28 years.

Dara has been progressing admirably well, including getting a grasp on all the new philosophy in my latest book. She is especially motivated since she is a singer trying to maintain a modicum of stage presence.

During her first workout (9/15/2018), she performed leg press FS, as it was staged as in TSC. Her initial values were 80 lbs/ 90 lbs/ 130 lbs for 30 seconds, 30 seconds, and 60 seconds respectively. This first leg press bout was *casually* (not rushed: no meaningful pre-exhaustion of the buttocks before leg press) preceded by TSC hip ABduction immediately after TSC hip ADduction.

During the ensuing weeks, Dara became more proficient at performing these three exercises—The Leg Press Triad—as well as more efficient at transitioning between them. In other words, the pre-exhaustion effect became more profoundly intrusive upon her leg press performance.

On November 30, I compelled Dara to cross that chasm between ATI and BTI. During her preceding workout, I had recognized Dara being very challenged to complete the leg press at 200 lbs for the full two-minute TUL. I knew that raising her leg press target would be where Dara was likely to figuratively come unraveled. And how subjects deal with this new experience can be quite varied.

Dara ramped confidently to 212 lbs and sustained it flatly for 40 seconds. But then she abruptly quit.

> Ken:
> Are you hurt? You can badly damage yourself by sudden relaxation like that. [Read article at end of treatise.]
>
> Dara:
> No, but my thighs are really burning.
>
> Ken:
> Then continue the exercise. Try to get back to your target, and don't let off as I will guide you through to the end by telling you how to think about the thigh burning.

Dara ramped back up to 212 lbs, then quickly sloped back down to 140 lbs.

> Ken:
> Did you decrease 70 lbs because you feel pain other than the expected thigh burn?

Dara:
No, but I can't push any longer.

Ken:
Yes, you can push, perhaps not strongly enough to maintain the target, but you can push... You can push all day.

Remember that "... but I can't push any longer" does not fall into your five-word vocabulary. *[yes, no, hot, cold,* or *ouch]*

If you are feeling pain, cease the exercise. If not, continue to push.

I know that your thighs burn. Think to push with your buttocks.

Where we want to go with this exercise is beyond the thigh burning. Your buttocks are doing not just most of the work here, but almost all the work. You will eventually learn to feel them over the thigh burn.

Dara:
I just can't do it.

Ken:
Your words are that you "can't do it" when what you can't do is not what I'm asking you to do.

I'm merely asking you to push.

I'm not asking you to hold 212 lbs. I'm asking you to try to attain and to hold 212 lbs.

You are quitting only because you cannot hold 212 lbs.

You demonstrated that you can hold at least 140 lbs after you could no longer sustain 212 lbs. 140 lbs is not zero.

> Therefore, you can still push. And this means you are DOING IT as you protest that you are not able.
>
> Stop the exercise, catch your breath, and we will talk.

Dara remained calm and cooperative, although she was perplexed, dazed, and struggling to understand my seemingly conflicted statements. [She is extremely intelligent and is motivated to save her bone density through muscular strengthening. She is also technically astute with a myriad of medical testing equipment.]

I repeated all the foregoing. I knew that removing Dara from the instinctual milieu of the exercise would enable her intellect to take hold of it completely.

I then explained the differences between the assumed process and the real process, and between the mistaken objective and the desired objective. Dara grasped these arguments immediately and could appreciate that they are as fundamental to exercise as the study of phonics is to learning to read and write.

On my white board, I drew the inroad graph from *Music and Dance*. (I give all my clients and prospective clients a copy of this book to serve as a primer as well as a reference for just such a moment as this with Dara.)

After reminding her that the graph was in her copy of the book, I showed her that once she has inroaded down to the target, she has attained classic failure (MMF: momentary muscular failure). This is that depth of inroad that corresponds to when she can no longer lift the weight selected in a dynamic exercise. And as Arthur Jones instructed us:

> Once you reach a point of fatigue—when using 100 lbs in an exercise—that you cannot continue moving the weight, this does not tell you how strong you are. It tells you how strong you no longer are.

A RenEx Leg Press Machine incorporating four load cells, junction box, force meter, computer, monitor and analog interpolation software.

> You might be able to produce 99 lbs, but since you must produce slightly over 100 pounds to move the weight, 99 lbs won't do it. But note that neither is 99 lbs zero!
>
> However, your body's nervous system will lie to you and convince you that 99 lbs IS zero and that your body is incapable of generating force when, in fact, you still are.

Then Dara complained that she had never before performed an exercise wherein she could no longer feel that her legs were responding to her will to push. This is a somewhat common experience with people new to exercise and new to deeply inroading. During leg press she could not feel that her legs were doing anything.

We have such effective techniques with FS that sometimes we are actually inroading past the momentary competence of the skeletal muscles and seemingly into the sensory nervous system... at least to the degree that muscular feedback is fuzzy.

By insisting that subjects like Dara resolve to think and to believe that they are mentally connecting to their buttocks—no matter what the sensory nervous system is lying to its owner about—then the graphics

... once she has inroaded down to the target, she has attained classic failure (MMF: momentary muscular failure). This is that depth of inroad that corresponds to when you can no longer lift the weight selected in a dynamic exercise.

display actually becomes part of the subjects' sensory feedback system.

Since inroading below target is never deeper than approximately 50% of target, the force produced by the subject is never zero. As the body torque/ weight of the limb is tared prior to an exercise in many cases, the force of muscular contraction can be viewed even when the subject's nervous feedback is muted.

Dara returned for her subsequent workout on 12/4/2018. Before commencing the workout she wanted to review all the discussion from the previous workout. She was still mystified that she had taken an exercise so deeply that she could not sense that her legs were effectively pushing—although her frontal thighs were intensely burning.

In addition to what was discussed during the preceding session I added:

> Your body does not know or care if you attain and/ or hold 212 lbs or any other number. Your body only respects your attempt, not your accomplishment. And you are allowing yourself to become emotionally upset about something that no one else—including your own body—cares about.
>
> When you observe the inroading falling beneath the target, this is success.
>
> And the faster it falls, the greater your indicative effort to elevate it to the target.
>
> This is the essence of *intensity* and Arthur Jones' second definition of intensity: *inroad/ time.*
>
> This is the *desired objective:* Trying to remain on target in order to fatigue the muscle. But staying on target to prove that you can is the *mistaken objective.*

I wrote a note on the back of the workout chart and told Dara about the note, but did not tell her what it said.

When Dara commenced the leg press, she ramped confidently to 212 lbs and held it perfectly for the full two minutes. Her entire workout was much improved.

Then I showed her the note. It revealed that I had predicted that she would graduate from the 212 lbs during that workout.

What's more, Dara performed the leg press for a full two minutes with 225 lbs on 12/6/2018, thus graduating again. She perfectly succeeded for the full two minutes with 237 lbs on 12/14, then with 250 lbs on 12/18, then with 262 lbs on 12/24, then with 275 lbs on 12/28, then with 287 lbs on 1/1/2019, then with 287 lbs again on 1/4/2019 (I wanted to see her obtain slightly more flatness in her trace.) As of this writing on 1/9/2019, she is scheduled to perform FS leg press this afternoon with 300 lbs—100 lbs more than what she believed she could sustain a little over five weeks before—50% more than she believed she could perform.

Statics, especially feedback statics, greatly simplify, but do not guarantee, our technological conveyance. SuperSlow technology greatly improved this from our Jonesian beginnings, and FS is another leap toward assuring understanding between instructor and subject.

Staying on target can be indicative of the assumed process.

Glossary

Following are the terms special to our use in TSC and FS exercise. Some of them are generic terms or phrases common to physics and physiology as well as general language. These are denoted as G.

Others are coined by persons in our field to specify particular concepts in our field. Their origins, if known or believed, are denoted by KH for Ken Hutchins, GD for Gus Diamantopoulos, RS for Rob Serraino, AJ for Arthur Jones, ED for Ellington Darden, DM for Doug McGuff, U for unknown, BH for Brenda Hutchins, SM for Steve Maxwell, KJ for Keith Johnson, Z for Jonas Gustav Vilhelm Zander.

Where G words or phrases have a special application or interpretation, they are noted with G, followed by the person of special adaptation.

above-target inroad (ATI)—KH—inroading, as viewed on an analog graph or with data points on a purely digital force meter, that occurs before the subject's readout descends below the target load. ATI is one of two factors that are invisible to the load cell(s), to the force meter, to the digital-to-analog software, and therefore to the viewer of the projecting monitor.

Note that above-target inroad does not refer to the achievement of a force value that is merely above the instructed target load. It is the inroading that occurs from the beginning of the initial ramp and up to the onset of BTI (See below.).

almost all—G-KH—somewhere between 90 and 99%. Compare to most. When you state that, "most of the exercises in my workout routine are static exercises," when only 5% of the exercises are dynamic, you should have stated, "almost all of the exercises..."

amplitude—G—the total distance between the peak and the valley of an analog trace; the distance between the highest and lowest number of a pendular swing (oscillation) of data points.

analog—G—(adjective) a trace or plot of values that leaves a history of those connected values as a straight, curved or jagged line.

Note that all analog traces begin with signals from a load sensor, or sensors. These sensors convert compression or tension forces into electrical signals that are sent to a *force gauge* which provides an instant digital reading of the forces applied to an apparatus.

The force gauge is connected to a computer with an interpolation software program that captures and displays the data to the user in a graphical, analog format for *load versus time*, whereby you can see both instantaneously current information as well as a history of the performance from the beginning of the exercise.

apparatus—KH—G—a machine or device used for exercise. See *machine* and *device.*

assumed process—KH-GD—part of a reconfiguration of Ken Hutchins' 30-year-old exposition of *The Assumed versus the Real Objective*, the assumed process is the performance of activity toward a notion of exercise with a focus and determination to lift the weight with conventional exercise equipment and/or to demonstrate strength by producing maximal force or by sustaining a target load, thus promoting outroading behaviors and excessive work volume and/ or with inefficient inroading, as in steady-state activity. This behavior (and approach) is marked by externalizing and is antithetical to the real process—inroading. It is hokum.

Examples of this include almost all purported forms of exercise that are more appropriately termed *recreation.* Some are ostensibly devoted to muscular strengthening and involve dangerous ballistic weight training or short TUL static loading. See also, *desired objective.*

at target—GD—The phrase of choice by an instructor to a subject when corroborating a displayed force measurement (or trace). Example: "…that's half-way and you are still 'at target.'" It may also be used in conjunction with a statement of performance, as in: "... the subject performed 62 seconds at target." This indicates that the subject sustained the target load for 62 seconds. Also, see *time at target.*

below-target inroad (BTI)—KH—inroading, as viewed with a trace on an analog graph or with data points on a purely-digital force meter that occurs after the subject can no longer maintain the target load.

bodytorque—G, GD, AJ, Z, KH—(noun) the torque effected by the mass, length, and mass distribution along that length of a body part due to the effect of the gravitational force. Torque is a product of force and lever length. (See *torque*)

Bodytorque is one of several interfering and frustrating issues with exercise—including stored energy and friction—that serve to randomly increase or decrease the resistance against a muscle. While it is difficult to manage the contamination aggregate of these issues in dynamic exercise, it is easily possible to circumvent all of these with static exercise.

Bodytorque can be measured and cancelled in dynamic rotational movements but not in dynamic linear movements, although some exercise equipment designers unrealistically try to negate this problem by putting the rotation in a horizontal plane (with axis vertical). Bodytorque can be managed in some quasi-compound movements—such as in trunk extension—if the degree of rotation is delimited.

We can compare products (torques), although we cannot compare the commutative pairs of multiplicands and multipliers of the products (torques) because the number of possible pairs are infinite for any given product (torque). Therefore, it is impossible to *literally* extract just one of the factors (force or lever length) of the product we call *bodytorque*.

However, with a static exercise on a load sensing apparatus (linear-form or rotary-form), we *can* effectively extract the *force factor* of bodytorque and render it nil via a procedure called *taring* with the use of a force gauge. The effectively extracted force factor must be subtracted from the gauge reading for the feedback during the exercise to be considered reliable. (See *force factor*).

Bodytorque and stored energy are often conflated, but they are separate issues and theycan present independently or in concert (See *stored energy*). But with Feedback Statics they can be easily dealt with simultaneously. Unlike stored energy, which is often random and varies between bouts, resting bodytorque is usually consistent from one bout to the next. In both cases, cooperation from the subject is required when taring the gauge. (See *tare, taring*.)

An example of bodytorque in an apparatus is the subject's feet and legs against the footboard of a SuperSlow Systems or RenEx Leg Press machine.

bout—G-KH—

1. a distinct exposure to a meaningful time under load (exercise). Bout is a more efficient way to express workout statistics. For example, a subject is furnished with two alternating routines: Routine A and Routine B. If the subject performs leg press exercise only in Routine A but not in Routine B, the instructor might say, "You are using the same target load as in your past three bouts." This indicates the past three workouts of Routine A (the routine that included the leg press exercise), not the past three workouts including Routine B. The foregoing example is a more convenient way to express, "the subject is using the same target load in leg press as when he performed leg press in the last three routines in which he performed leg press." Thus this awkward and insufferable mouthful is greatly simplified. In the case that the subject performs the same routine in every workout, the use of bout is not as decisive. In such a case, the last three bouts is the same as the *last three workouts.*
2. in static exercise, the preferred term over set to indicate a series of sequential stages of effort. (See also, *set.)*

compound movement—AJ—exercise movement involving multiple joints such as a chest press, pull down, compound row, leg press. It is basically linear-form. Compare to *simple movement.*

data points—G—numbers representing distinct force values observed in static exercise performed on feedback equipment.

data set—G—a grouping of distinct values (numbers), especially those three numbers representing the force values observed in the three stages of TSC.

decrement—G—a decrease in force applied to an apparatus as indicated on the display of a feedback system (analog or digital).

de-ramping—KH—the reduction of force and effort that terminates the bout. Note that de-ramping is not inroading. It is not the force loss displayed when BTI occurs. Force decrement during inroading is unintended and concomitant to increased or continued effort.

[Note: While inroading occurs as soon as ramping commences, no further inroading occurs during de-ramping (in most cases).]

desired objective—KH—(updated)—formerly *the real objective*, the desired objective is the exercise stimulus. This stimulus is the intended result of *the real process* (inroading) as well as the signal for the body to respond with upgrades in strength and other factors of physical conditioning. Also see *mistaken objective.*

device—G-KH—an incomplete exercise mechanism. Often portable, a device may provide an obstacle to exert against but not a seat. To use a device, the subject is required to furnish a support on which to sit or lie. A device must never be used while standing, despite the widespread marketing of exercise devices that displays otherwise. See also, *machine* and *apparatus.*

digital—G—describes a feedback device that provides only data points with no analog capability to provide a plot of the performance history. Of course, an analog device obtains its source information from a digital source before interpolating it to analog plot and history.

dynamic—G—an exercise wherein gross movement of the body or body part(s) occurs.

dyskinesia—G—disordered, involuntary movement.

dyad—KH—the performance of two distinct exercises, one after another, in direct succession, with minimal transition time between the two exercises. A dyad satisfies the pre-exhaustion principle. See also *Triad.*

effort—G-KH—the willful determination to contract the target musculature in a given exercise. Effort generates inroading—the process to get to the exercise stimulus.

externalize—KH-KJ—to perform activity intended for exercise with a mentality to make the exercise equipment react. Example: football players attacking the football dummy or sled. This is an improper mentality for exercise and caters to the assumed objective.

fatigue, fatiguing—G-KH—(noun, verb) specifically applied to the *momentary weakening* or *inroading* during a bout of a given exercise. Compare to *weaken* or *weakening.*

feedback statics (FS)—KH—static exercise performed with either digital or analog observation of the subject's performance. This observation can be by the subject, the instructor, third parties, or all of the above.

flat—GD—on an analog graph shown on a display monitor, the characteristic of a force trace that is level and horizontal. Not to be confused with *steady.*

An unsteady trace may be considered flat if the mean force values are consistent, but such a trace should not be considered satisfactory. In such a case, the instructor must determine what steps to take to correct this kind of performance, including the possibility of a reduced target load. Also, although a flat trace may be indicated as ATI, such does not automatically mean that a progression is necessarily appropriate.

force (force output, force measurement)—G—*force* is difficult if not impossible to define (except by mathematical relationships), but we can see and use its effects. Muscles produce force.

Force is a specialized term that we use to denote this production by the muscles. We do not use other terms for force—*pressure, weight, intensity, load*—that are applied in other particular applications.

Force can be measured in various units, but the most common metric unit is the *newton (N).* In standard inch (British or Imperial) units, *pounds* are the unit force, despite their ubiquity as units of weight. One pound is equal to 4.448 newtons. *Force* is often conflated with *torque,* which is a *product* of force and lever (not technically a force), that tends to cause rotation. Where newtons and pounds are units of force, *newton-meters* and *pound-feet* are units of torque.

force factor—KH, G—In strict usage, bodytorque is a special torque, but still a torque nonetheless, and not to be conflated with a force. And like any torque, it is a product of two *factors*: lever length and force. Hence, we refer to one of these factors as the lever-length *factor* and the other as the *force factor*. When a subject produces bodytorque in an apparatus, it is not the bodytorque that is read by the force gauge but rather the force factor OF the bodytorque.

force gauge—G—a digital force gauge *(also indicator)* is designed for tension and compression force measurement. The gauges used in PUSH devices and RenEx machines feature high sampling rates which produce instantaneously accurate values under a wide range of applications. A backlit graphic LCD displays large characters, and a menu is available to access the gauge's features and configurable parameters. USB output is provided for data collection purposes and to connect to a computer and software.

frequency—G—(noun) how often an exercise (bout) or a routine or a workout is performed by a subject. We speak of the frequency of a bout or the frequency of a routine or the frequency of a workout (which might differ with routines).

function—G—the term given to describe anatomical actions of the body. Not to be confused with equipment *mode(s).*

graduate—(verb) GD—to move up or to progress to a higher target load after a successful bout.

graduation—G—the receiving or conferring of a progressive promotion to a higher target load.

Progressions in target load must be curated individually and based on a number of variables including the evaluation of the performance, the achievement of ATI or BTI, the associated TAT, the subject's experience, and considerations for injuries. Also see progression.

graph—G—the plot of a subject's performance of a static exercise. Normally, this plot has a trace between multiple data points related to the time transpiring during the bout.

high-intensity training (HIT)—ED—true exercise; activity that produces meaningful inroad with brief workout routines of a minimum of muscle isolation movements with extended rest of several days between workouts. In recent years, "HIT" has become greatly marginalized and conflated with all kinds of rubbish and obscene, illicit, and dangerous practices. We try to avoid the expression.

hokum—G—nonsense; something apparently impressive or legitimate but actually untrue.

increment—GD— an increase in force applied to an apparatus as indicated on the display of a feedback system (analog or digital).

inroad, inroading—ED—momentary fatigue in a bout of a given exercise effecting a declining force (strength) capability of the subject.

It is easy to assume through our writing, (as well as others' writings) that we are stating that inroad is the exercise stimulus. But this is not what we mean.

The *desired objective* of the exercise is the stimulus. But that exact stimulus has yet to be identified (although there may be several competing ideas for what it is). And even if we identify the actual stimulus, it may have little to no bearing on the process to obtain it. (i.e., the inroad).

Within any subject the point of stimulus may actually move deeper along the inroad path as the subject proceeds from novice to intermediate to advanced levels of effort and strength. Ken Hutchins has addressed this in his presentations as well as in *Music and Dance*. *Inroading* is the *process*, or the means to get to the *stimulus*, which is the desired objective of exercise.

Exercise and its benefits are presumptive.
Note that the degree effort is predicated on willed activity, but the degree of effort is not confirmed by activity.

And inroad is predicated on the degree of effort, but meaningful inroad is not confirmed by the degree of effort.

And the desired stimulus is predicated on meaningful inroad, but that stimulus is not confirmed by inroad, because we cannot know if the inroad is meaningful.

And beneficial growth is predicated by the attainment of the desired stimulus, but this growth cannot be guaranteed, because we do not know how the body will respond to the stimulus. Depending on the body's resources, it may become stronger or weaker or even damaged.

The stimulus *does not make* the body become stronger.

We can make the body weaker. We can injury the body. We can deplete its resources. But the body *may* become stronger if the stimulus is provided and *if* we *allow* the body to respond in a positive manner.

intensity—<u>AJ</u>—

1. the degree of momentary effort (Nautilus-era definition). Although still relevant, this definition might be better suited to describe a workout overall, rather than applying to a bout of one exercise. *Intensity* is not to be confused with *force*. In fact, in a controlled exercise setting, the higher the intensity of muscular contraction, the lower the force may be. Hence, Renaissance Exercise philosophy is considered to be high-intensity, low-force. [It is confusing that *intensity* is sometimes and archaically used to mean *force*. This misusage is not within the context of proper exercise discussion.]
2. *inroad/ time* (MedX-era definition). This definition specifically applies to the intensity of a single bout of one exercise. Within the inroad/ time definition, the Nautilus-era definition still applies, although subjective. Intensity is subjective for the overall workout and almost all dynamic exercises, but it is visible (and possibly measurable) on a static exercise apparatus with analog feedback. Intensity be visualized at and after BTI on an analog readout. The faster inroad is observed, the greater the intensity. As the subject is exerting progressively harder, the inroad occurs faster. Thus *inroad/ time*.

internalize—<u>KH</u>-<u>KJ</u>—to mentally connect to the muscles inside your body to contract without respect to the actions of the joints, bones, or the object externally exerted against. This proper for exercise and caters to *the real objective*.

interpolation—<u>G</u>—the process of calculating an approximate value based on values that are already known. In other words, multiple values are converted, in a sense, to be viewed as a connecting line.

isometric—<u>G</u>—describing a static exercise wherein the subject exerts against an immovable object. *Traditionally*, this is performed with a maximum effort for a bout length of 5-15 seconds. This traditional approach is extremely *high-force*, it has limited inroading efficiency, it is fraught with excessively uncontrollable outroading issues, and is therefore dangerous. The Renaissance Exercise approaches to static exercise—i.e. TimedStaticContraction and SuperStatics—*isometric* in a loosely general sense, but are performed with the implementation of guidelines to rectify the traditional issues.

Equipment produced for SuperStatics is designated with an “i” preceding an abbreviation. The “i” preceding a machine or device name stands for *isometric*. Thus, “iPOPD” stand for “isometric pullover-pulldown.”

The literal meaning of *isometric* is *same measure*. And its intended impression was that the muscle performed a contraction involving no movement. Since muscular contraction is muscle shortening, this impression is misleading. However, the static property during this mode of exercise might reasonably apply to the apparatus exerted against.

Jonesian—G—of or related to the exercise philosophy and exercise equipment (Nautilus) by Arthur Jones.

judder, juddering—G—machine vibration and/or resonance caused by the muscle tremors and/or dyskinesia of the exercise subject's body.

load cell, load sensor, (also sensor)—G—(technical)
A load cell, or load sensor, or just, *sensor*, is a force transducer. It converts forces, such as tension or compression, into an electrical signal that can be measured and standardized by a *force gauge*. Data from the force gauge can be sent to a computer to be plotted by software and displayed graphically to the user.

machine—KH—a complete exercise mechanism or apparatus. Typically not portable, a machine provides a seat and an obstacle (handles, foot board, movement arms, etc.) to exert against. See also *device*.

meaningful load—KH—a force requiring a level of effort causing inroad deep enough to stimulate muscular growth and/or strengthening.

minimum time at target load, MTAT—KH—in static exercise, the minimum acceptable duration for a target load. Generally, beginners require a longer MTAT as they learn the protocol and gain experience. If a subject's TAT (time at target) is briefer than the MTAT for that exercise (and subject), then the instructor may elect to reduce the target load at the next bout. Advanced subjects with more experience can achieve a higher target load, tolerate deeper inroading, with earlier BTI and with a briefer MTAT. See also *TAT.*

mistaken objective—KH—formerly *the assumed objective,* the mistaken objective is the result of *the assumed process.* It is the undesirable outcome devoid of a growth stimulus and with increased probability for injury. It is an outcome with poorer conditioning and with enhanced but impractical skill that is erroneously confused with improved strength and endurance. Activities attributed to the assumed process necessarily pursue the mistaken objective, which essentially is a deterrent to the stimulus.

mode—KH—the term given to indicate the operational purpose of an apparatus as it relates to the type of exercise or activity (manual, dynamic, static TSC or FS, or other uses). Not to be confused with *anatomical function.*

> Example: A RenEx Leg Press can be used in four modes for leg press: manual, static TSC, static FS (if with feedback electronics), and dynamic. The Leg Press can be used in three modes for heel raise. The Leg Press can be used for one mode for shoulder shrug. It can be used for hip ADduction and ABduction in two modes each. And it can be used in two modes for hip flexion. Therefore, its mechanics are useful for at least six exercises (there are more), but each exercise may have a different number of possible modes.

most—G-KH—somewhere between 50 and 99%. This is an overused descriptor that often leaves incorrect impressions. If we state that most people exercise, some readers will assume that the number is close to 100% while some other readers will assume it's only slightly more than 50/ 50. Political pundits often use the phrases *landslide* or *vast majority* to indicate a constituency voting on an issue that is 60-70% since voting outcomes are rarely won with much more than 50% majorities. Be wary of using or reading these descriptors. Compare with *almost all.*

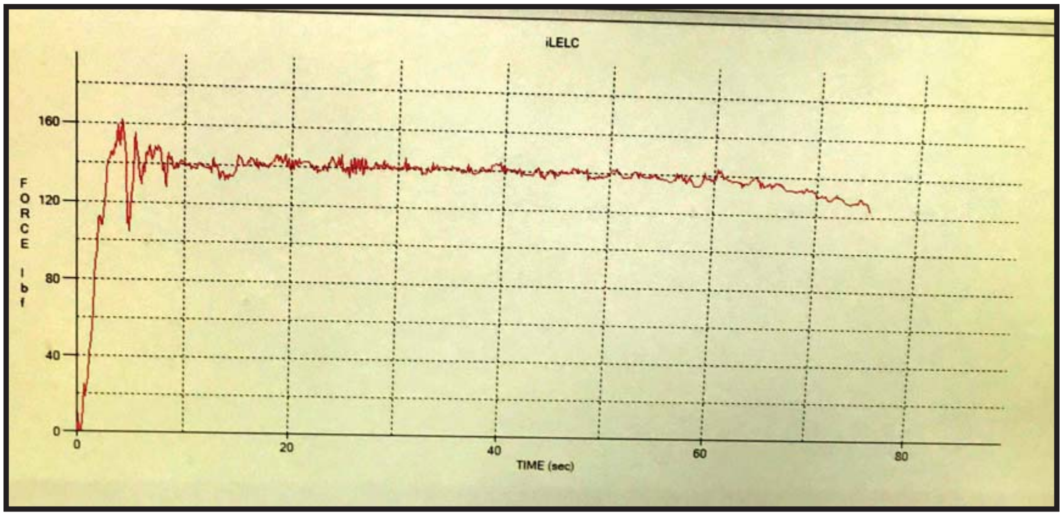
outroading—RS—the opposite of inroading. The opposite of isolation. This is a remarkably useful term as it encompasses a mouthful of discrepancies—Valsalva, teeth gritting, grimacing, gripping (the three Gs) and a host of out-of-control behaviors as thrashing, yelling, screaming, grunting, slamming weights, embracing the assumed process and the mistaken objective, etc.—that are difficult to discuss as a collection. For years at Nautilus, we had to run down the entire litany every time it came up in a sentence. Now—once the term is defined to the listener—we can use one word in subsequent discourse. It saves using an insufferable mouthful just as does *bout.*

Outroading wastes energy, focus, will, and throws these limited resources outside the body—as in externalizing—rather than intellectually sending them inwardly to the target musculature—as in internalizing. See *externalizing, internalizing.*

over-correcting reflex (OCR)—KH-GD—excessive downward swing of a trace caused by overshoot caused by too-fast ramping. See *overshoot, overshooting, ramping.*

overshoot, overshooting—G-GD—ramping beyond the target load. How we couch this idea naturally assumes that overshooting applies exclusively to FS. But reckless ramping occurs in dynamics as well as in TSC. In dynamics, it results in ballistic behavior.

With TSC, it manifests with the subject exceeding stage levels. Of course, such exceeding is usually *invisible.* It is not entirely invisible when it produces injury or unique sounds in the exercise equipment.



Blatant Overshooting: Subject ramps too quickly to 140 lbs during static leg extension exercise causing overshooting by 20 lbs, then exhibiting over-correcting reflex to 107 lbs (a 53-lb swing: 38% of target swing), then overshooting again by 15 lbs, then reflexing again to 132 lbs before providing a relatively flat trace. This is a veteran subject possessing poor focus although her flat trace implies somewhat average motor control. She needs to be more careful, to use a longer ramp time.

Compare to *spike, spiking.* Overshooting and spiking are usually related as spiking often causes overshooting, but the two terms are not synonymous. It is possible to spike while not overshooting, and it is possible to overshoot while not spiking.

plot—G—a graphical display of data points. *Curve* and *graph* are similar terms.

progress, progression—G—an increase in load or TAT or both, signifying an increase in strength. Of course, many other physical improvements will be concomitant with the strengthening. See also *graduate* and *retrogression.*

purpose—KH—the *purpose* of exercise is to produce benefits (enhancements and growth) to your body that improve the quality of your life.

PUSH (Personal User-feedback Static Hardware)—BH-KH-GD—trade name for the portable, wireless static devices by Gus Diamantopoulos.

ramp or ramping (also de-ramp or de-ramping)—KH—going from zero effort and force to the target effort (TSC) or to the target force (FS). Ramping also refers to going between stages of effort—as in going from stage 1 to stage 2 or from stage 2 to stage 3—during TSC.

real process—KH—inroading. The real process involves *internalizing*. Also see *assumed process*.

retrogress, retrogression—KH—retrogression is the opposite of progression. But to discern the meaning of retrogress or retrogression, it must be placed in one of two contexts. Not *regression*.

In one context, retrogress (verb) applies to the subject. A subject who retrogresses is losing strength and conditioning. If a subject is unable to reach a target load or TAT, despite having done so successfully in the past, this may signify a decrease in strength and conditioning.

In the other context, retrogress (verb) applies to the instructor. An instructor decides to retrogress the subject by reducing the target load or TUL. The decision to retrogress a subject is discretionary and depends on any number of factors from excessive BTI, to a failure to achieve a MTAT, to any of the possible discrepancies that a subject may demonstrate.

Retrogression (noun) is not necessarily a sign that the subject performed poorly or that he is weaker. Retrogression may occur merely as an indication that the target load is set too high to allow MTAT with requisite controls (form). An example of this is when an instructor selects a stage value from the TSC determining set for transitioning to FS that is too high for an appropriate MTAT. In this case, the instructor retrogresses the subject to arrive at a target load concomitant with a more suitable TAT.

See also *progression, time at target (TAT), minimum time at target (MTAT).*

routine—G—a collection of exercises and their sequence performed in a workout.

set—G—
1. in dynamic exercise, a series of sequential repetitions performed in a given exercise.

2. in static exercise, a series of sequential stages of effort in a given exercise. See also, *bout.*

simple movement—AJ—an exercise movement involving a single joint in each limb such as a biceps curl, knee flexion (leg curl), knee extension, pullover. It is rotary form. Compare to *compound movement.*

spike, spiking—G-GD—
1. (verb) a sudden application of force evident by the verticality of the trace in FS. Of course, verticality is dependent upon time lapsed and the force obtained. To explain, a ramping of 400 lbs in five seconds shows much greater verticality than ramping to 100 lbs in the same time.

2. (noun) the resulting vertical line on a graph representing a sudden application of force.

Compare to *overshoot, overshooting.* Overshooting and spiking are usually related as spiking often causes overshooting. But it is possible to spike while not overshooting and it is possible to overshoot without spiking.

stages, staged—G—(noun, verb) discreet levels of effort in a TSC exercise bout. See also, *set.*

After finally obtaining some good control of her trace and sustaining it on leg press exercise, I asked this subject to attempt to raise her output to 300 lbs for the last 10-12 seconds (circled part of the trace). She immediately began to moan and to lose force. I managed to coax her to open up her breathing and, thus enable her trace to rise to a level slightly above her foregoing trace.

This experience became instructive for the subject. The analog history of what she did incorrectly, its consequence of reduced output, and its corrective measure was manifest. Without feedback statics this kind and degree of correction and education for the subject is almost always impossible. Dynamic exercise can never offer this!

static—<u>G</u>—something still, exhibiting no gross movement.

static hold—<u>U</u>—refers to a *loose* variation of pure statics whereby the subject is presented with a live and loaded movement arm with the challenge of holding it in place for a predetermined TUL. The static-hold mode offers better loading and control than dynamic mode, but still unnecessarily incites outroading behaviors that compromise the real objective. Not recommended.

statics—G—exercises wherein no gross movement occurs of the body or of the targeted body part. Traditional isometrics as well as TSC, FS, and SuperStatics are all versions of statics in the exercise realm. *Statics*—in formal engineering parlance—refers to the study and analysis of forces as they are structured within the tolerances of various fixed engineering designs. All engineering schools place heavy emphasis on mastery of this subject. Major application of the equation *force x distance = force x distance* is made.

steady—GD—on an analog graph shown on a display monitor, the characteristic of a force trace that is stable and uniform in the relative peaks and valleys of amplitude on the waveform. Steadiness is desirable in and through all stages of effort, including ramping, de-ramping. Not to be confused with flat. A stable trace can be flat to indicate ATI, or it can slope downward thus indicating force decrement and BTI.

stimulus—G—the chemical/ mechanical event that signals the body to improve or to retrogress. It is likened to a switch. See *inroad, outroad*.

stored energy—AJ, GD, KH—the potential energy in the body from one of two possible sources. One source is due to the tonus in a stretched muscle. For example, when a hip is significantly flexed, its corresponding buttocks muscles are stretched thus increasing force within the muscle in the direction of extension.

Another source is due to compression. For example, when a subject's thighs are squeezed between the four pads of the iADAB device, this compression is potential energy. The materials of the pads as well as of the body tissues are elastic and prone to return to their previous shape before deformation due to the compression.

Stored energy manifests as force on the apparatus. Like the force factor of bodytorque, stored energy force must be subtracted from the force gauge reading for the feedback during the exercise to be considered reliable.

Stored energy and bodytorque are often conflated, but they are separate issues and they can present independently or in concert (See *bodytorque*). But with Feedback Statics they can be easily dealt with simultaneously. Unlike bodytorque which is usually consistent from one bout to the next, stored energy is often random and varies between bouts. In both cases, cooperation from the subject is required when taring the gauge. (See *tare, taring*.)

SuperStatics^{SM}—KH—Ken's new pending service mark to distinguish the precision with what we practice and promote at SeriousExercise from the haphazard statics performed throughout the fitness and physical therapy communities.

This is Ken's marketing term to distinguish our technical verbiage, practices, philosophy, etc., from the scattered and undisciplined thinking, beliefs, and practices that are widespread regarding exercise, with particular emphasis on static mode.

surge-sync—KH—a discrepancy marked by continuous off/ oning, often rhythmically synced with ventilation. Since it rarely involves Valsalva (but can), it is distinguished from *Valsalva sync.*

tare, taring—G-GD-KH—one of two functions for which a force gauge must be manually calibrated; the other being zero (see *zero*, *zeroing*).

Taring calibrates the gauge by setting it to “0.0” after subtracting the contamination aggregate of extraneous forces acting on the apparatus so that you can accurately measure the concomitant exertional force from a subject during FS exercise.

In a similar manner, when following a large tractor-trailer note the stenciled message that reads something like:

- Gross 100,000 lbs
- Tare 56,000 lbs

This tells the authorities at the weigh stations that the trailer weighs 56,000 lbs empty and that its maximum combined weight of both contents and trailer is 100,000 lbs.

If you weigh out a quantity of food (beans, cereal, grain, etc.), you must place the food in a container, but you are not interested in the weight of the container. Therefore, you first place the container—empty—on the scale and tare the scale which calibrates it to "0.0". This operation is *taring the container.* Then you add the food to the container and reweigh the container with the food in it. Since the scale has been tared, it will measure only the weight of the food.

A gauge on an apparatus can be *tared* to subtract the force factor produced by the subject's bodytorque and/or the force produced by the subject's stored energy (see *bodytorque* and *stored energy*). It can also be tared to subtract the force factor of the torque produced by a machine part (movement arm), when required (see *torque* and *force factor*).

After a gauge is *tared*, the force factor of the subject's bodytorque OR the force from the stored energy of the subject OR the force factor of a movement arm's torque is still acting on the apparatus, but it has been subtracted from the gauge reading.

In an apparatus where a force factor of a bodytorque and/or stored energy is produced, a tared gauge will read a value above "0.0" when the subject exerts against the sensor OR if he releases his contact with the sensor, as this will add back the subtracted value. It will read "0.0" only when the subject is in contact with the sensor(s) and in the same relaxed state as he was during the *taring* procedure.

In an apparatus where a force factor of a torque of a machine's movement arm is produced, a *tared* gauge will read a value above "0.0" when the subject exerts against the sensor OR if the movement arm changes its position relative to the sensor, as this will alter the subtracted value. It will read "0.0" only when the movement arm is in the same position that it was in during the *taring procedure.*

In FS, when an aggregate of extraneous forces acts on an apparatus prior to exercise, a *tared* gauge is the only way to acquire a reliable measurement during exercise.

Note that *taring* is a procedure, and the *tare* is the effect of that procedure on a force gauge. Neither the sensors nor the subject nor the machine/ device is tared.

In the broadest terms, *taring* is the removal of one force from the gauge to get an accurate read for another force.

Example: When the subject places his feet on a SuperSlow Systems or RenEx Leg Press footboard, the force gauge will read the force factor of the bodytorque produced by his legs PLUS the force he exerts on the footboard. Therefore, to measure only the exertional force produced by the legs, the force factor of the bodytorque of his legs must be subtracted via *taring*. The taring procedure must take place before the exercise commences and with the subject's feet perfectly placed and relaxed.

Specific taring procedures are required for specific apparatuses.

target load, target force, target—GD—the measured value to maintain during an exercise, usually read on a force gauge or computer display monitor. The preferred term is *target load.*

time at target (TAT)—KH—the subject's targeted muscle group begins to inroad as soon as the subject begins to ramp toward the target. TAT is the duration successfully maintained at the target, excluding ramp time. Compare to *TUL.*

For various reasons, some subjects require an inordinate amount of time to ramp. If a subject takes 40 seconds to ramp to the target and then sustains the target for the entire remainder of the TUL (TUL = 90 seconds; Set = 90 seconds), this presents an inherent problem.

As normal ramping is 5-10 seconds with a subject successfully sustaining the target for the remainder of a 90-second TUL, the TAT is 80 seconds. For the subject who ramps for 40 seconds, the TAT is only 50 seconds. These subjects, therefore, cannot be equally considered for graduation.

Similarly, if a subject's TAT is briefer than the prescribed MTAT (minimum time at target) for that exercise (or subject), an instructor may elect to reduce the target load at the next bout. See also, *minimum time at target*, or *MTAT.*

TimedStaticContraction (TSC)—KH-SM—a protocol for static exercise wherein a subject loads the musculature against an immovable object through distinct stages of effort over a given duration.

time under load (TUL)—DM—

1. the duration a subject's targeted muscle group is subjected to meaningful load. See *meaningful load.*
2. the duration of an exercise beginning with and including the ramp time

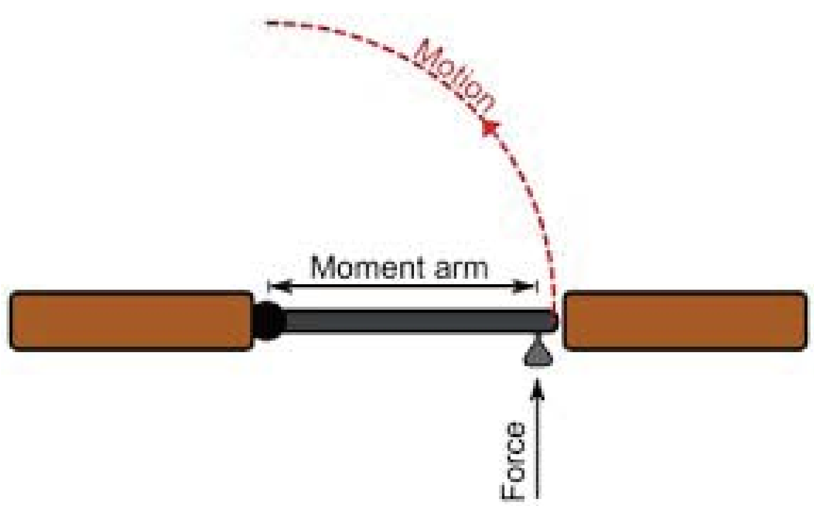
but excluding the de-ramp time. Compare to TAT.

torque—G—Torque is the expression of a force that causes a tendency for an object to rotate about an axis. Note that torque is *not* the force that causes the rotational tendency as force is always linear. It is the product of force and lever length which causes the rotational tendency.

Force causes acceleration. In simple terms, it is a push or a pull. Comparatively, torque is what causes an object to acquire angular acceleration or, rotation. Torque is a vector quantity, which means that the direction of the torque vector will depend on the direction of the force about the axis.

Sometimes the terms *moment*, or *moment of force* are used interchangeably with torque. The radius of acting force is commonly called the *moment arm*.

Torque can be dynamic or static. *Dynamic torque* produces an angular acceleration. *Static torque* does not. Someone pushing on and opening a closed but unlatched door is applying a dynamic torque. Whereas someone pushing on a closed and latched door is a applying a static torque because, although there is a force acting on the door, it is not rotating.



Above: The gray circle and rectangle is the door with the gray circle being it's hinges… (the entire gray shape being the moment arm)… the black arrow is the direction of force (someone pushing on the door) and the red arrow is the direction of motion of the door/moment arm… the brown rectangles are merely the walls.

trace—G—the line created by analog software that connects the plots of data points emanating from a subject's force performance. Both digital-only force gauges and analog software, in general, provide a readout, but only the analog software produces a trace. In other words, digital-only force gauges do not provide a trace.

triad–KH—the performance of three distinct exercises, one after another, in direct succession, with minimal transition times between the three exercises. A triad satisfies the pre-exhaustion principle. Also, see *dyad*.

un-contract, un-contracting—ED—the act of lengthening—but not relaxing—a muscle under meaningful load as experienced in negative-only exercise.

Valsalva—G—action characterized by abdominal back pressure against a closed airway. Although the closed airway is usually at the glottal level, this closed airway could also be by a musical instrument or something like a balloon. An effect of Valsalva is reduced cardiac output due to reduced venous return. Also, venous blood pressure (not arterial blood pressure) may rise greatly and momentarily, depending on the extent of the Valsalva.

In and of itself, Valsalva is not dangerous, but it is to be avoided in exercise as it is a factor of de-isolating the subject's muscular engagement. What's more, Valsalva is usually the first in a cascade of behaviors termed *outroading behaviors.*

The other outroading behaviors do raise blood pressure on the arterial (left) side of the circulatory systems and do pose threats to safety during exercise. Hence, although Valsalva is not of much direct concern in exercise, it is of indirect concern.

The Valsalva maneuver, or simply Valsalva, is named after the 17th century Italian anatomist Antonio Valsalva, who first used the technique to study the human ear. In proper exercise, we may consider Valsalva and breath-holding to be interchangeable terms, although cessation of breathing is possible without Valsalva.

weakening—G-KH—generalized loss of strength. Not used in conjunction with the momentary fatigue or inroad. Compare to *fatigue* and *fatiguing.*

zero, zeroing—G-GD—one of two functions for which a force gauge must be manually calibrated; the other being tare (see *tare*, *taring*).

Zeroing calibrates the gauge by setting it to “0.0” when no extraneous or unwanted forces are acting on the apparatus. For *zeroing* to be possible, nothing must touch the sensor(s). After a gauge is *zeroed*, any contact with the sensor will produce a measurement.

In FS exercise, when no extraneous force acts on the apparatus prior to the exercise, a zeroed gauge is the only way to acquire a reliable measurement during exercise.

Exercises wherein no stored energy or bodytorque is present require zeroing instead of taring.

Warning:
Never Suddenly Collapse Your Effort!

by Ken Hutchins

For the West Point Project in 1975, Nautilus founder and owner, Arthur Jones, instructed his nephew, Scott LeGear, to build about eight strength-testing machines. At a glance, their overall color (the standard Barbados Blue with black Naugahyde upholstery) and shape gave the impression of a regular Nautilus exercise machine. Closer inspection revealed that they each provided crooks in place of their weight stacks where conventional strain gauges could be hooked in line with the force of the subject's effort.

In the late 1970s and the early 1980s I saw these measuring devices in the massive junk pile at Nautilus. In fact, it was my responsibility and decision to send them to the scrap yard per the regime that bought Nautilus directly from Arthur in 1986.

If you consider the many thousands of dollars invested by Arthur to build these measuring devices—merely to haul them up to West Point to test a score of subjects before, and then again, after the experiment there—and then haul them back to Lake Helen, Florida and have them put in the junk pile for ten years, you appreciate only one level of Arthur's energy and effort.

But when you then learn, as I did later in 1978, that it was all for naught, because the strain gauges—although obtained from a reputable lab—could not be calibrated, then you appreciate a great and disappointing waste. But all Arthur's efforts in this regard DID produce one bit of valuable information:

Never Suddenly Collapse Your Effort!

During each test on these crude devices, each West Point subject was carefully instructed to gradually build (We now say, "ramp.") into a maximum effort. This was done because Arthur's staff was well versed on the dangers of any explosive, sudden application of force. But still, several of the subjects did get hurt while performing these tests. The common injury was a pulled (strained) hamstrings muscle.

What no one could predict was that the injuries all occurred—not during the feared and carefully managed application of force—but during the de-application of force... the let-off, the relaxation immediately after the maximum-effort test. We could never explain this danger. We could only acknowledge it. As Arthur repeatedly stated in those days, "We don't understand gravity, but we do know not to go walking off tall buildings."

In the early 1980s, I injured a hamstrings performing a test on an infimetric computerized Nautilus prototype. I was shocked that I was injured as I knew not to suddenly release my effort. Arthur noticed me limping the following day, and after I told him how I became injured, he launched into the West Point experience. Quickly sensing that I already knew the story and had, indeed, applied great care with the entire procedure, he seemed momentarily dumbfounded.

Silently, I decided static testing could never be made safe, especially if I was injured—and I being well aware of the dangers and safety procedures—how could I expect anyone else to perform such testing safely? Note that this was several years before the founding of MedX.

And although we do not perform or recommend testing to be performed with our static equipment and approaches, and although the muscle is to be deliberately deeply fatigued—hence, no longer able to render its maximum and most dangerous force—before terminating an exercise, it still deserves warning to slowly un-contract the muscle. Don't merely collapse the energy field, so to speak.

I borrow this last phraseology from my early experience with ignition systems in small and large internal combustion engines. Note that the typical lawn mower does not have an on-board battery; however, a large voltage is sent to its spark plug with each rotation of the flywheel. Where does this voltage arise from?

A magnet resides in the flywheel that closely passes a coil with each rotation. By disturbing the magnetic field, a current is induced in the coil and sent to the spark plug. Some refer to this system as a magneto.

Before the advent of electronic ignitions in the 1970s, a larger engine—such as that in an automobile—sent a much larger voltage to its spark plugs. It obtained a relatively small voltage from its on-board battery to send through the primary windings of its coil. This current created a magnetic field around this primary winding that collapsed each time the mechanical points opened, thus sending a huge voltage down the secondary windings that were wrapped around the primary windings. The current induced in the secondary windings went instantly to the spark plugs.

I'm not saying that the collapsing magnetic field surrounding the primary winding of a coil is the same as that in a muscle. I merely see similarity with the abruptness of the collapse and the corresponding force that accompanies it.

So, no matter what we eventually learn about the nature of a sudden collapse of effort, instruct all subjects to slowly decrease their effort. De-ramping should take about as long as ramping, perhaps slightly longer.

Thanks much to Lou Gardner for editing this. Also, thanks to Brenda Hutchins and Kevin Fontaine for proofing. All of it was also reviewed and edited by both Ken Hutchins and Gus Diamantopoulos. Thanks so much again to Anastasia Koretskaya, Brenda Hutchins, Grace Liebolt, and to John Daly for their posing and data contributions.

Note: All contents of this treatise and glossary are material for test questions on the new SuperStatics Certification.

As this may disappear from my website, please download the PDF to your computer and save and disseminate to anyone and everyone that might use the information. Also, please download other PDFs.

Ken would greatly like that *Bashing Cults 2.0* (non-exercise articles page) also be shared with anyone in social studies or in the media.

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