Ends to Middle Approach to Sprint Training

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Introduction

This article is meant to help simplify the sprint events training from a largescale programming view. In this philosophy, there are two sides of training, speed and an endurance side; In the middle is the race itself. Training should progress through the year from the two respective ends towards the middle, each step coming closer to the specific race demands. This training philosophy can be applied to any of the sprint events (60-400), although slight modifications may be required due to the respective race demands.

Speed End

- **Acceleration**: Runs at 90-100% intensity, between 10-40m in distance depending on the athlete's ability (faster/stronger/older athletes will be able to accelerate further). Acceleration workouts typically consist of 3-5 sets of 3-5 runs of 10-40m. Typical volumes for this method will range from 200-400m. Easy rule of thumb for rest intervals are 1 minute per 10m between reps, and cumulative rest intervals between reps for rest between sets (i.e. set of 4 x 20m, 2 minutes between reps, 3 rest intervals times 2 minutes equals 6 minutes between sets).
- **Top speed**: This quality is trained through runs of 4-7 seconds (40-70m) at speeds of 90% or higher of an athlete's maximum speed (runs at speeds less than this 90% threshold do not drive the neural demands needed to improve/train max speed ability). Younger, slower athletes will reach top speed earlier in a run; therefore, their runs must stay closer to the lower end of the distance range to not bleed that training into speed endurance. Typical volumes range from 300-600m of work, although less is often more here as the quality of work trumps volume. Because of this, rest intervals remain high, 4-8 minutes depending on length of run and intensity.
- **Short speed endurance**: Can be further broken down to **alactic** short speed endurance and **glycolytic** short speed endurance. These workouts consist of multiple sets of multiple runs between 30-80m between 90-100% intensity. The distinction between alactic and glycolytic lays in the rest intervals between reps and sets. Longer rest intervals keep the primary energy system in the anaerobic alactic system, while shorter rest intervals lead the primary energy system to shift to the anaerobic glycolytic system. Rest intervals for ASSE (alactic) should hover around 2-3 minutes between reps, and 5-10 minutes between sets. Rest intervals for GSSE (glycolytic) shift down to 1 minute between reps and 4-5 minutes between sets. Typical volumes for these sessions range between 300-800m of work.

- **Speed endurance:** The ability to maintain near max speeds over extended distances (80-150m). This work occurs between 90-100% intensity with 5-10 minutes of rest between reps. Volumes can range from 300-900m of work.
- **Special endurance 1**: This includes reps between 150-300m in distance at intensities of 90% and up. Typical volumes hover between 400-900m, with rest intervals of 10-15 minutes. Typical special endurance 1 sessions consist of 3-4 runs. It should be noted that this quality is on the speed side of the spectrum even with "endurance" included in the name due to the duration of reps. Most athletes (past the MS level) will be able to run reps of 150-300m in times of 40 seconds or less. This is important as the acidosis experienced during high intensity activities over prolonged periods do not present problems until this 40 second mark.

Endurance End

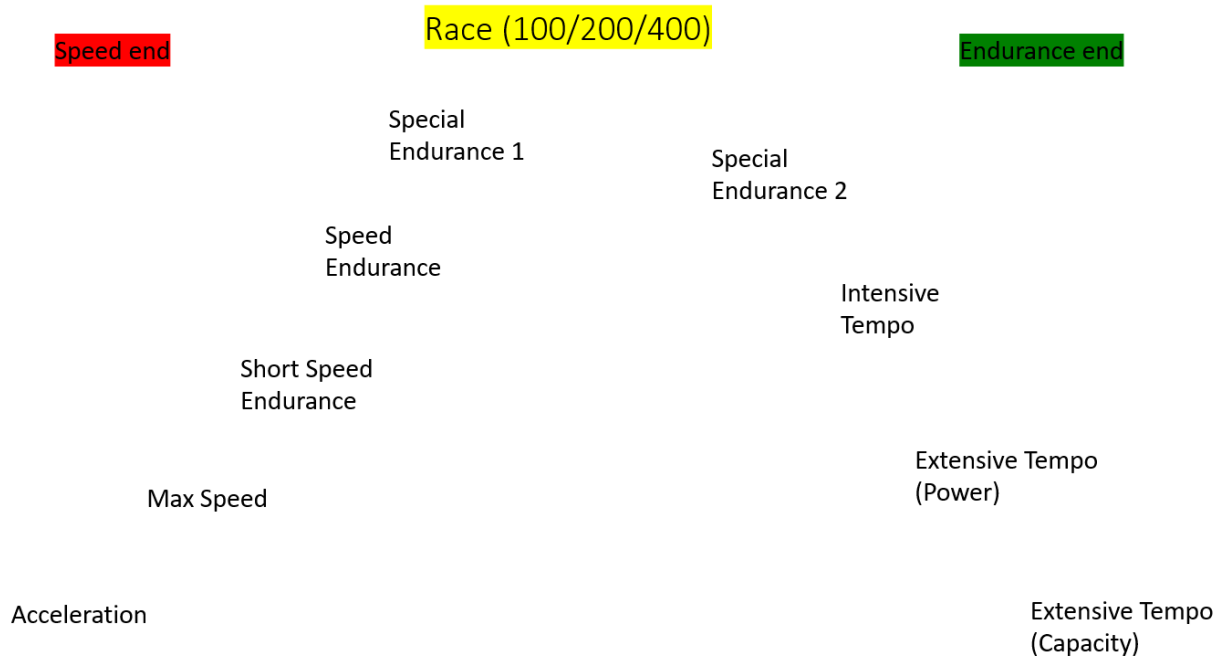
- **Extensive tempo**: This is characterized by runs below 80% intensity, which can be further broken down into categories of **aerobic capacity** (<69%) and **aerobic power** (70-79%). Runs in this category are up to your own imagination and can be any distance further than about 100m. I would pose the question of what is the benefit of running reps of great distances (>600m) for sprint athletes (especially 100/200m runners)? As the distance increases, the speed of execution must drop. Rather than run 800m reps for example, I would recommend shorter reps of 100-200m with reduced rest intervals. This would accomplish the same goal of the further rep workout but would preserve posture and mechanics, keeping quality of work much higher. Typical volumes of extensive tempo sessions can largely vary, ranging from 1000-3000m of work. A good starting point would be 1200m as this gives you enough volume to progress from to more intense work later in the training year. Rest intervals in this work are low as intensity levels are also low. <69% runs can see rest intervals of 45 seconds to 2 minutes, with 70-79% runs having 1 to 3 minutes of rest. These workouts can be made in straight sets (6 x 200m) or in multiple sets (2 x 3 x 200m).
- **Intensive tempo:** Also known as anaerobic/lactacid capacity, runs range between 80-89% intensity. Reps can be anything 80m and up, but distances can not be further than a certain point to ensure intensity stays inside the specified range (80-89%). Volumes typically hover between 800-1600m, but your volume used here must be less than volume used in the extensive tempo sessions performed earlier as intensity and volume have an inverse relationship. Sessions typically contain 3-6 runs. Rest intervals can range between 3 to 5 minutes.
- **Special endurance 2**: Reps of 300-600m at intensities of 90-100%. Typically, sessions of special endurance 2 consist of 1-3 runs as they are extremely taxing. As special endurance 1 is on the speed side, special endurance 2 lands on the endurance side due to the time length of reps (>40 seconds). This subjects the athlete to high levels of acidosis during the rep, which is why this form of training is also known as "lactic acid tolerance". Rest

intervals for this quality are HUGE as the quality and intensity are so great. 15 to 20 and even up to 30 minutes is not uncommon in this type of work.

Notes on Volume and Intensity

One overarching theme that should be understood regardless of method used, is in structuring the workout to ensure the quality wanting to be trained IS ACTUALLY being trained. To do this, the interplay of distance of reps, intensity of those reps, and the total volume of the session must be considered. As distance of rep increases (within the confines of the specific quality), intensity can drop, rest intervals can expand, or total volume can be reduced to accommodate for this change. For a specific example to highlight this concept we will look at a hypothetical speed endurance workout, 4 x 120m @ 95% intensity with 8 minutes rest between reps. If one were to expand these reps to 150m, a good coach should weigh this change and adjust the workout (if seen as necessary). Maybe this coach drops the intensity to 92%, or moves the rest interval up to 10 minutes, or drops the number of reps down from 4 to 3. There is not an absolute need to change anything, but the concept of understanding and acknowledging this interplay is extremely important when programming for the sprint events.

Ends to Middle Pyramid



How Training Differs Between Events

All sprinters should train across the spectrum, the volumes and emphases of each component is where their training will differ. For example, while a 100m runner should train extensive tempo, this does not mean they should necessarily run repeat 300m reps. Not to say you can't do this with that athlete, but I would question the efficacy in how well this session prepares the athlete for the future, more specific, work to come. Bottom line, look at the specific event demands and work towards that quality, we'll look at the 100m race to highlight this. The 100m race is characterized by an aggressive acceleration to 30-40m where the athlete reaches their top speed and holds it until the 60m mark. Following the 60m mark, the athlete will see slight deceleration until the 100m mark. This decrease is due primarily to the discoordination and fatigue of the nervous system, as opposed to the inability for the body to produce adequate ATP to fuel the activity (as seen in an event such as the 400). Why then, would this athlete's training have a focus of and subsequent high levels of special endurance 2 work, where they operate in a completely different energy system and demands in their respective event?

Logical Progression

On both ends of the spectrum, each subsequent step follows a logical progression. On the speed side, we start with acceleration (0-40m) which prepares the body for demands of the next step, top speed (40-70m). Once these top speed qualities are developed and stabilized, we begin to work on our ability to maintain speeds, close to our maximum, over multiple reps of 40-70m with short speed endurance. Speed endurance abilities follow the development of top speed abilities because, if speed is not developed first, what is it that you are enduring? Following this, we extend out to true speed endurance, reps of 80-150m at speeds still close to maximum. Last, we once again extend rep distances to our last quality on this side, special endurance 1. Reps of 150-300m in which we are training our ability to maintain high speeds over extended distances. On this end of the spectrum, we can notice that the progression is centered around the extension of rep distances/volumes while keeping intensity high (>90%). Simply, learning to run fast for longer.

On the endurance side we once again see a logical progression with each subsequent step. This progression, however, is seen primarily in the intensification of work from low to high. Beginning with extensive tempo at intensities of <79%, we transition to intensive tempo in the 80-89% range. Last, we end with special endurance 2 work that steps up once more to 90-100% intensities. As intensity increases, volumes follow an inverse relationship and drop. This highlights the need to set volumes high enough in the extensive tempo phase to have a path to drop it as intensity increases.

General to Specific

Touching further on this progression up the ladder, it is important to note that the lower steps represent work that is more general in nature, with the middle representing the most specific work (race itself). These general abilities lower on the steps allow for the next step's work, which is more specific, to be performed to a greater effect. The lower steps PREPARE the athlete for the next

step's work. While acceleration and extensive tempo may or may not have direct effects on increasing an athlete's performance levels in their event, they do prepare the athlete for top speed and intensive tempo work to come. This idea carries all the way up the steps, allowing for the most effective speed endurance/special endurance work to be performed, which does have direct effects on the athlete's performance levels in the sprint events.

Tempo Training Hate (Feed the Cats)

Before we move further, I would like to address the current hot topic of tempo training. On social media, tempo training has gotten a lot of hate as it is "not specific" to sprint athletes and running slow cannot help an athlete run faster. This idea is not wrong, slow tempo training is not going to make an athlete capable of producing faster speeds in a race. BUT, tempo training, if used to progress to more specific work as discussed in the prior section, can absolutely lead to greater performances. The true problem lies in how a coach progresses training, anything (hypothetically) can be used if there is a logical progression from current training to future training. Running 200's at 28 seconds (extensive) will not make a 21 second 200m athlete faster, but this workout can prepare them for 250's at 32 seconds (intensive tempo), which can prepare them for a 220, 200, 180 at 24, 22, 20 seconds respectively (special endurance), which CAN make this athlete faster in their 200m event.

Progressing Through a Season (Career)

Throughout a season, we can divide it into preparation and competition phases. Within preparation, it can be further divided into general and specific preparation phases. Competition phase can be divided into precomp and competition phases, denoting early season and late season meets respectively, but for the sake of this article we will keep them grouped as one singular phase.

- **General Prep**: Focus is on training general abilities and preparing the athlete for the next phase of activities. In this phase, the main training focus should be on acceleration and extensive tempo, starting on either end of the spectrum in the speed and endurance realms.
- **Specific Prep**: This phase is about preparing the athlete for the very specific training to be performed within the competition phase, as well as preparing them for the competitions themselves. Training in this phase should then focus on top speed and intensive tempo, the next steps in the spectrum.
- **Competition**: Once in the competition phase, the training should be one of three things
    - 1) Specific to the event demands and pushing improvements in abilities resembling the event
    - 2) Restorative in nature to recover from or in preparation for the specific training to come
    - 3) Stimulative to keep the nervous system's rate coding and muscle recruitment abilities progressing.

These days build the framework for polarization of training intensities which we will talk about later. The training focus in this phase should be on all three types of speed endurance, and both special endurances (which ones used will depend on the athlete's events, i.e. 100m runner will focus more on short speed endurance and speed endurance while a 400m runner may work more special endurance abilities as these are more specific to their event).

- **General to Specific**: Training should progress from general to specific, this is true in all contexts. Over the course of a training session, season, year, and career. Early in an athlete's career, a training year should be biased more towards general activities, with the general prep phase constituting a large portion of the year. As the athlete matures and approaches high performance training, the opposite is true; The year is tailored more to specific qualities, with the general prep phase making up a smaller portion of the year, and specific prep/competition phases making up a greater portion.
- **Special Endurance Work**: These highly specific, very taxing workouts produce environments with high levels of lactate. This accumulation of lactate is a nervous system irritant which takes large amounts of time to recover from and diminish speed and subsequent skill acquisition abilities (very important during general/specific prep) because of this irritation. Therefore, these workouts should be delayed as long as possible within both a training year (well into competition period) and athlete's career (use VERY sparingly with athletes under 17 years old if long term athletic development is main goal).

Training Youth/Elite Athletes

Running along the same lines as the previous section, training youth athletes versus collegiate and even post collegiate athletes differ in application of general or specific training proportions. As an athlete develops, their speed, strength, and endurance levels will naturally increase through puberty and maturation, reaching peak levels in late teens for females and early 20's for males. It would be a good idea to keep training emphases on the lower steps of each spectrum for youth athletes (acceleration/extensive tempo). As the athlete begins to approach their natural ceiling in these respective qualities (speed/strength/endurance), training should begin to move up the steps to see continual improvements. Trying to stay on the low end of the steps as long as possible, allowing for the max development of these general qualities, lays a greater foundation to build specific qualities later in their career. If this idea was ignored and training began moving up steps closer to specific work before natural ceilings were approached, you would be diminishing their genetic potential in that respective quality. A good metaphor to think of is squeezing the juice out of an orange, make sure to leave some juice to squeeze when the athlete is 21+. Otherwise, this athlete is likely to see early stagnation as their specific qualities were maxed out early in life.

Speed is King (Tide that raises all boats)

Top speed ability is the most important quality for a sprinter to have, it is the best predictor of success in any of the sprint events from the 60 to the 400 (we will talk about the importance of

speed v. endurance in the 400 soon). This ability lays the foundation for the speed endurance and special endurance work to come later, increasing the effectiveness of it. When looking at the 200/400 events at the elite level, top speed abilities are a pre-requisite for high level performances. The best predictor for elite performance in the 400m is an athlete's 200m PB, and the best predictor for elite performance in the 200m is a 10m fly (It is not surprising that the current and former world record holder in the 400 both have 200m PBs under 20 seconds). Endurance will only take you so far in these events if top speed abilities are underdeveloped. This problem is extremely apparent and troublesome at the youth level. With young athletes having low speed/power levels due to underdeveloped nervous system capabilities and unproportional reliance on the aerobic system, often the biggest gains are possible in the sprint events through improving endurance abilities. Coaches chase short term gains, while ignoring the long-term development of the athlete. This manifests itself in an athlete who has tapped out their endurance abilities early in development without the corresponding speed levels needed to be successful at senior level competitions. Endurance can be developed rather quickly, walk to your mailbox and back and you will be more aerobically fit. Speed on the other hand? The necessary neurological pathways and muscle coordination required take years to decades to develop. Focus your efforts here early and often in an athlete's career. The last idea surrounding top speed for sprinters is the concept of speed reserve. As top speed increases, their submaximal speeds also increase, thus creating a speed reserve. To simply highlight this, take two people who are bench pressing; One has a max of 400lbs, while the other has a max of 250lbs. Who do you think will be able to do more reps of 225lbs? The athlete with the higher max, obviously. But what if the athlete with the 250lb max has REALLY good strength/muscular endurance? Still going to be the athlete with the higher max. No matter how developed an athlete's endurance abilities are, the athlete with a higher top speed will have a higher ceiling in terms of their speed endurance/special endurance and respective 400m abilities.

Organizing Training Days (Neural/General)

When organizing training for sprinters, a general rule of thumb is to group activities based on the neural demand. Activities with a high neural demand (sprinting, jumping, throwing, lifting) should be grouped together on one day, with low neural demand activities (tempo running, general strength circuits, mobility routines) grouped together on other days. These two days highlight the concept of polarization of intensity in training, which send clear biochemical signals to the body on what qualities are being trained. Keep high days high, and low days low. Mixing activities can send mixed signals to the body and hamper the training effect. Like to think of this concept with the idea of cooking one single dish versus a full Thanksgiving dinner, which one will produce the higher quality product? High days send signals on improving neural abilities, such as improvements in rate coding (ability to activate muscle tissue quickly) and muscle recruitment (ability to activate more high threshold motor units, thus more muscle fibers). Low neural days help improve the body's general fitness levels, often providing a restorative effect like a rest day. How does more work equal recovery though? This effect comes from the small lactate production that accompanies activities such as extensive tempo running and general strength circuits. These lactate levels cause an endocrine response to occur that releases human growth hormone into the bloodstream, resulting in the restorative effect mentioned previously. With the high/low approach

to organizing training, you can train opposing energy systems to high levels without negatively affecting the other. These days should be generally organized in a 50/50 ratio.

Stimulation versus Progressing Abilities

Diving deeper into high days, some sessions will provide a stimulative effect, while others will serve to push the boundaries on very high intensity qualities (top speed, speed endurance, max strength, rate of force development, etc.). To circle back to earlier discussion on training in different phases, general prep will be characterized by primarily stimulative days. Specific prep will then see the addition of these higher intensity days where the "athlete is made" so to speak. Stimulative days will remain in the program to keep rate coding and recruitment abilities in check between these bouts of the high end work. Once in the competition period, the stimulative days remain, with competitions taking the place of the "athlete making" days. If there is a large break in competition, these days can be placed back in to continue the improvement of specific abilities. This concept is important to remember, as competitions should be considered when looking at a training program, they provide the best training effect possible, adjust accordingly. Next, we will look at how to adjust training during important competition periods.

The Forgotten Training Parameter: Density

In the context of training, there are three parameters that a coach can adjust. These parameters are volume, intensity, and density. Volume being the amount of work, intensity being the effort level of work being performed (easy/hard), and density being the amount of work being performed within the confines of a certain amount of time (minute/day/week/month). Coaches often adjust the first two but seldom use the third, density. As a season progresses, the athlete should be improving in their event specific abilities (speed endurance/special end., etc.) as they adapt to the training. This improvement may not be realized as associated fatigue accumulates, keeping performances low, but will be seen as the fatigue is dropped. This highlights the two-factor theory of fitness that shows the interplay of fitness, fatigue, and performance. To see this drop in fatigue, the easiest/best way to alter training is to decrease the density of those high intensity days mentioned previously. For example, work that may have been performed once a week would shift to once every 10-14 days, things done three times a week will shift to twice a week, etc. While one alters density, keeping volume and intensity of workouts similar throughout could be a good idea. Dropping volume or intensity of these while also dropping density could diminish the stimulus applied to the athlete, possibly leading to regression. For example, if 3 x 120 @98% with 10-12 minutes rest has regularly been performed, changing the workout to 2 x 120 @98% or 3 x 120 @90% could lower the stimulus provided and change the effect had (especially during this time where the athlete's fitness is at peak levels and are better able to handle these workloads). Adding in more lower intensity days/off days while decreasing the density of the specific workouts (increasing the proportion of high neural days to general days from 1/1 to 1/2), will lead to improvements in performance as fitness gains are able to shine through once fatigue drops.

Closing Thoughts

Sprint training is most effective when the work performed is specific to the athlete's event. This highlights the SAID principle (specific adaptations to imposed demands), you become what you do. But this training must be worked towards and cannot be started at the beginning of a training year (nor the beginning of training career), this would lead to less effective work and is potentially dangerous as tension levels would exceed the body's current capabilities. Coaches need to take athletes from where they are, and progress training to where the athlete needs to be. This will look different for different levels of athletes. Younger athletes should spend more time training on the lower end of spectrum, with older athletes focusing more of their time on the higher, more specific steps. Understand where an athlete is in their development and train them accordingly.