



Musculoskeletal

The Run Style Spectrum

A unified concept of running technique every clinician, scientist, coach and runner should know about!

Author : Ben van Oeveren, PhD

During running, every step will create a specific mechanical load. Therefore, running technique is inextricably tied to injuries and efficiency. Runners, coaches, clinicians, and scientists aim at minimising injury risk while optimising performance with measurements and analysis.

Unfortunately, false claims and misleading interpretations are commonly made. Why? Because biomechanical parameters are often analysed, presented and interpreted in isolation.

Running styles cannot be understood by a single parameter. You should consider biomechanical interdependencies. Based on current literature, we synthesised a unified concept for analysing the running technique: The Run Style Spectrum.

The Run Style Spectrum describes the most fundamental parameters of running technique and is therefore paramount for any analysis and interpretation. The Run Style Spectrum is based on the notion that all limb movements and muscular forces aim at transporting the body as a whole. The Run Style Spectrum describes the sinusoidal Body Centre of Mass (BCoM) trajectory.

The main characteristics to describe the BCoM trajectory are step frequency and the duty factor (the ratio of stance time and stride time) as assessed at a given speed. These parameters culminate in a framework that describes the full spectrum of running styles.

Based on this Run Style Spectrum, the ground reaction forces, forces within the body and segmental movements can be predicted. Furthermore, energy expenditure, force capacity and local mechanical loading can be clarified using the Run Style Spectrum.

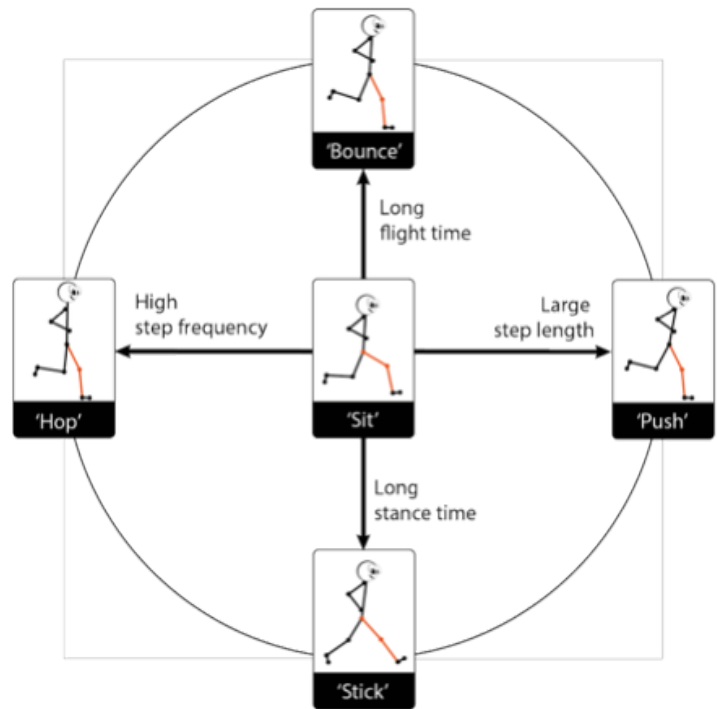
Each running style requires specific energy and force capacities. For example, to run at low step frequencies (Push) requires high force generation capacities, while running at high step frequencies (Hop) will require good coordination and endurance. Running with long flight phases (Bounce) will require high elastic energy capacity and strong tendons. Consequently, problems with the Achilles tendon are likely related to the Bounce-style runners.

Local mechanical loading also depends on the kinematics of each running style. For example, the longer stance times (Stick) arise from foot placement anterior to the body. The Stick-style runners may especially be susceptible to tibialis-located injuries.

As described, each running style is associated with a specific injury risk profile. Without changes in the running style, the local mechanical loading will remain the same. Thus, when a particular running style results in an injury, the injury is likely to repeat. For the treatment and prevention of running, injuries clinicians and coaches should consider gait retraining.

The proposed Run Style Spectrum provides a practical overview to guide future measurement and interpretation of running biomechanics. The Run Style Spectrum can be applied in practice (measured with commercial devices even) and creates a convenient framework to study further, prevent and treat injuries or optimise performance.

Want to read deeper into this topic? The free full text article is available online [here!](#)



Call for running data

We can use your help! We are continuing research on the running styles and recruiting runners who want to share their data. Help us by sharing our call for participants within your network. To get info, please contact us: info@move-metrics.nl

Altmetric score

This review has received the highest Altmetric score in the journal Sports Biomechanics over 2021: 95! More information about the score can be found [here!](#)

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