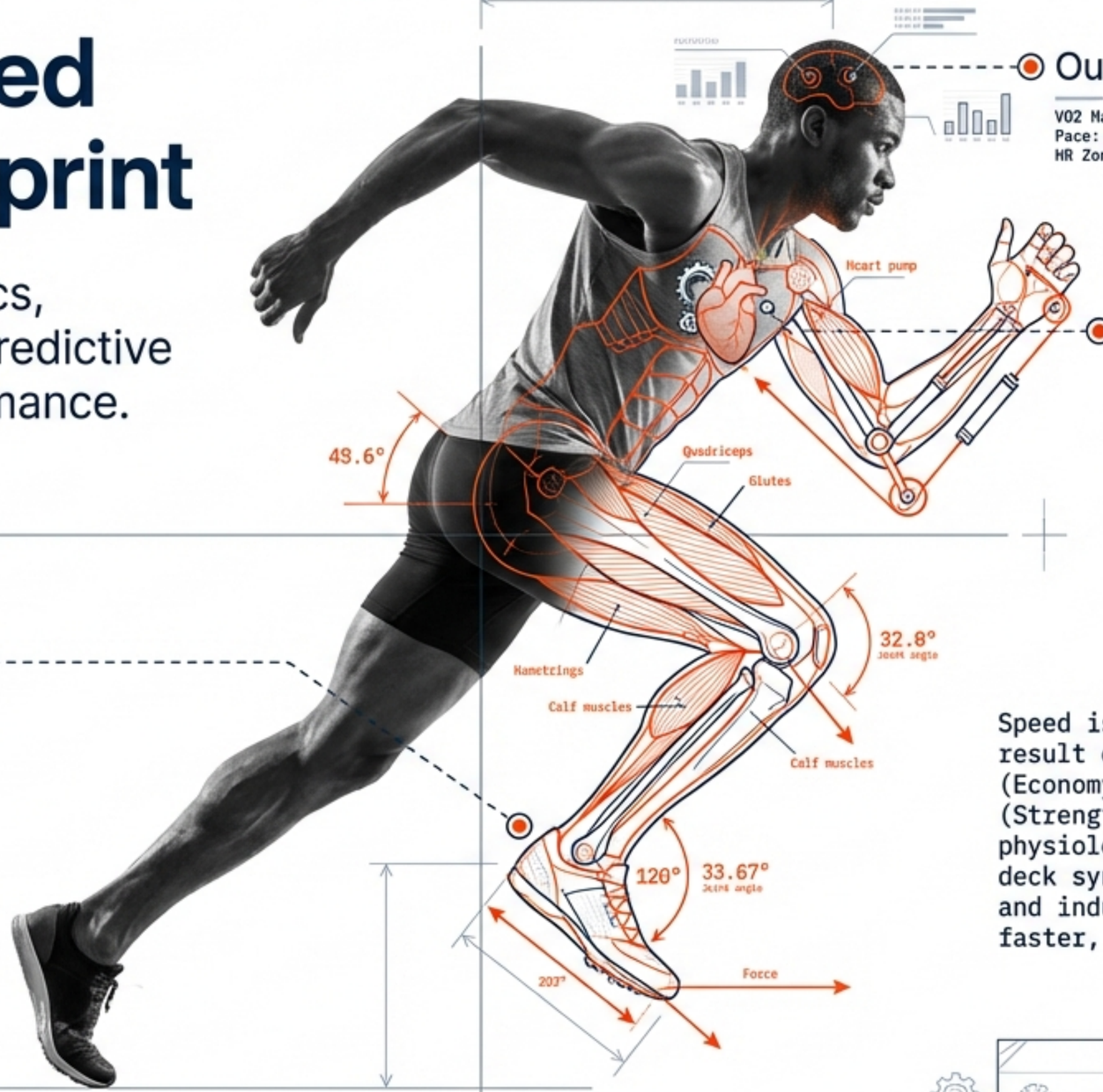
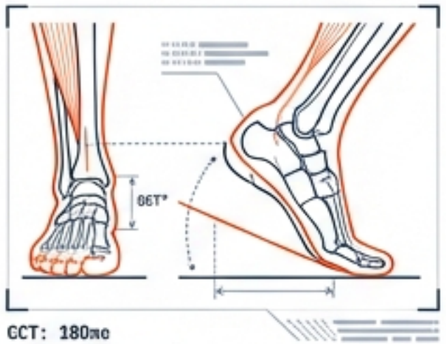
The Optimized Runner Blueprint

Synthesizing Biomechanics, Structural Integrity, and Predictive Analytics for Peak Performance.



Mechanics (Form)



GCT: 180ms
Cadence: 190 spm
Strike Efficiency: 92%

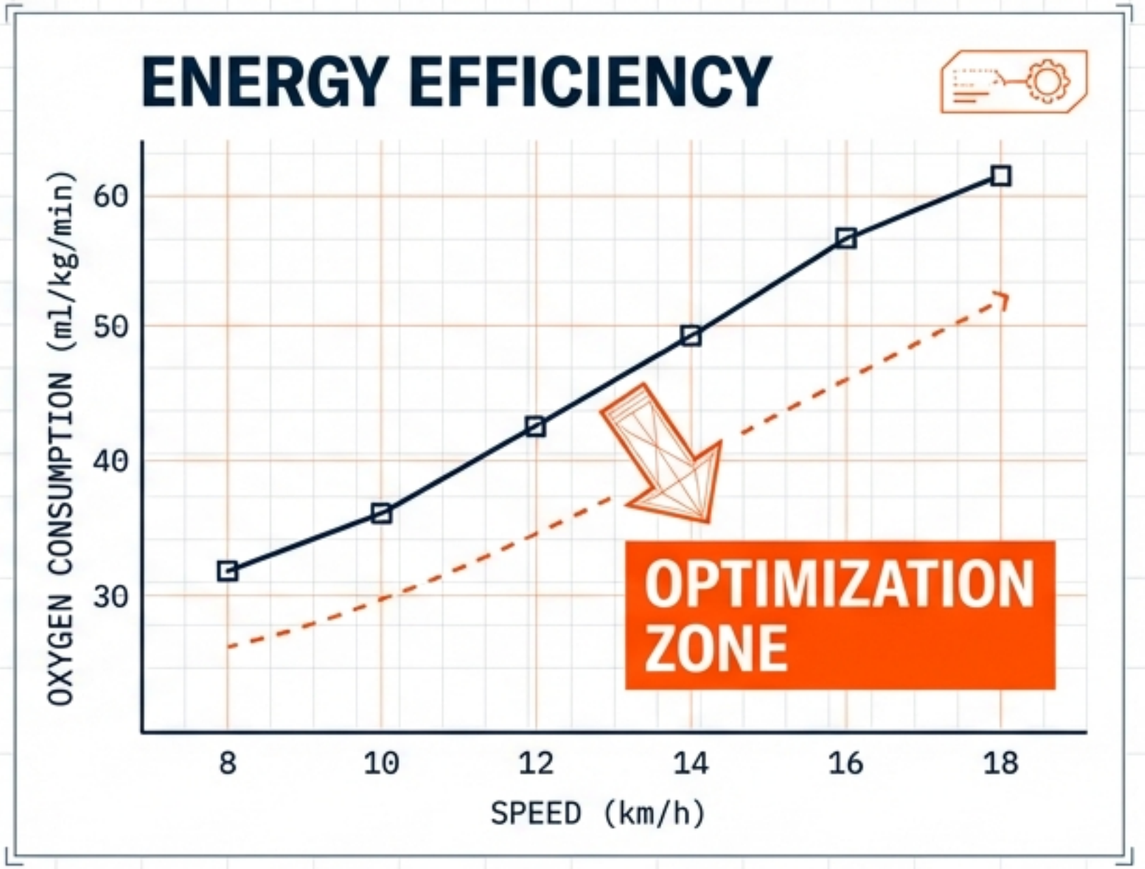
Speed is not accidental. It is the result of efficient movement (Economy), structural durability (Strength), and predictable physiological thresholds (Data). This deck synthesizes academic research and industry expertise to engineer a faster, more resilient runner.

PROJECT: CPTIRIZED RUNNER V3.0	
DATE: 2024.05.15	REV: A
DRAWN BY: SPORTS SCIENCE UNIT	

THE OBJECTIVE: RUNNING ECONOMY (RE)

PRIMARY SOURCE: DR. ISABEL (IZZY) MOORE, CARDIFF METROPOLITAN UNIVERSITY.

RUNNING ECONOMY IS THE SPECIFIC ENERGY COST OF RUNNING. IT IS MODIFIABLE AND TRAINABLE.



THERE IS NO SINGLE ‘PERFECT’ RUNNING TECHNIQUE FOR EVERYONE. HOWEVER, THERE ARE MODIFIABLE BIOMECHANICAL FACTORS THAT DIRECTLY AFFECT RE. EFFICIENCY MUST BE PAIRED WITH LONG-TERM HEALTH AND INJURY EPIDEMIOLOGY.

The KPIs of Movement

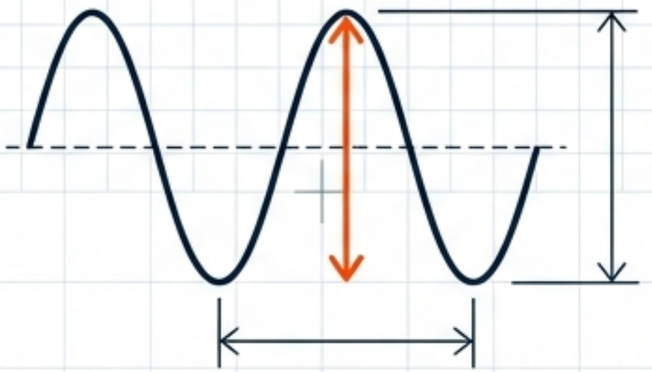
Quantifying form with wrist-based accelerometry.

CADENCE

Range: 140 - 200+ spm

To run faster, you must increase cadence, step length, or both.

VERTICAL OSCILLATION



Range: 6 – 15 cm

Optimization: Lower is better. Vertical energy is wasted; the goal is forward motion.

GROUND CONTACT TIME

Range: 100 – 300 ms

Optimization: Lower contact times (<200ms) generally correlate with higher speeds.

THE SELF-OPTIMIZING MACHINE

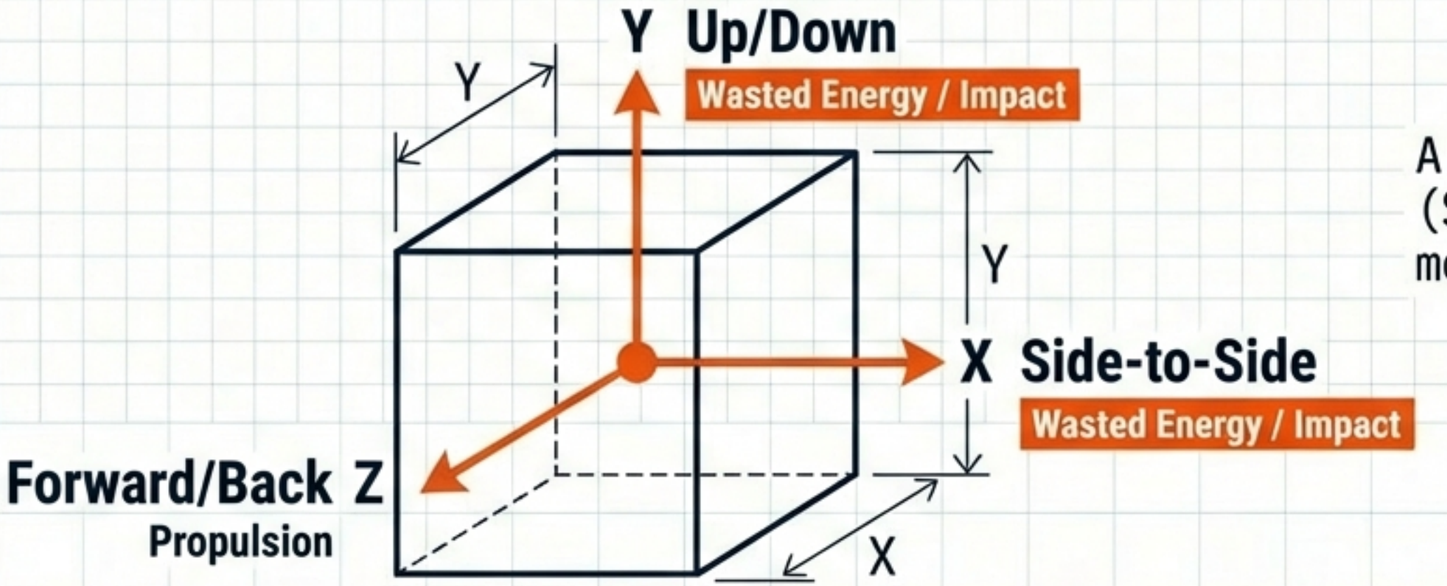
Over time, runners naturally drift toward their most economical stride pattern.

MYTH: THE PERFECT FOOT STRIKE

- Research lacks evidence that forefoot striking is inherently more efficient.
- Forefoot striking is often an EFFECT of speed, not the cause.
- Heel strikers may be injury-prone, but drastic changes increase risk.

ACTION: Do not force drastic changes. Increasing cadence by 5–10% reduces impact forces without breaking the system.

Running Smoothness™ & Impact



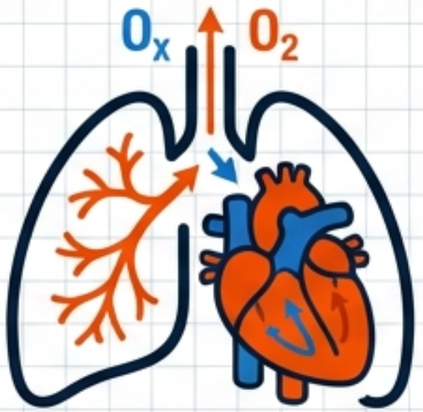
A unit-less value (Scale: 50-150) quantifying movement in three dimensions.

Logic: Higher Smoothness = Lower Impact Forces + Less Wasted Movement.

Tip: Maintain core stability to minimize lateral sway. Experienced runners run smoother.

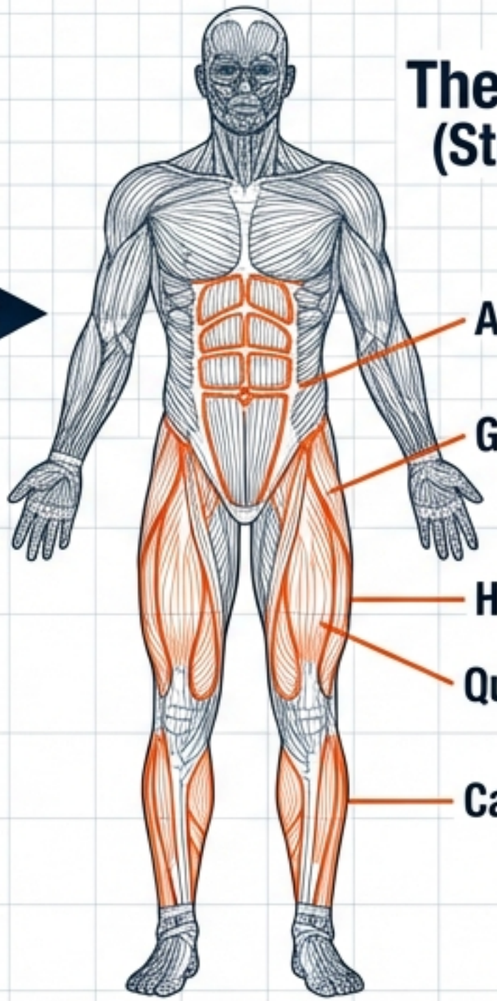
Building the Chassis

FURMAN INSTITUTE OF RUNNING & SCIENTIFIC TRAINING FIRST



The Engine
(Aerobic)

Fatigue breaks the chassis before the engine fails.



The Chassis
(Structural)

- Abdominals
- Glutes
- Hamstrings
- Quadriceps
- Calves

5 Goals of Strength Training:

1. Improve local muscular endurance.
2. “Pre-hab” for injury prevention.
3. Counteract age-related muscle/bone loss.
4. Improve economy (lower oxygen consumption).
5. Increase time to exhaustion.

The Runner's Strength Protocol

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Strength Train	Key Run	**Strength Train**	Key Run		Key Run	

Frequency: 2 sessions per week (Non-negotiable).

Key Principle: Eccentric Contractions. Strengthening muscle while lengthening reduces injury and decreases Ground Contact Time.

Key Exercises: The Prime Movers

Movement 1: Split Squat / Lunges

Target: Quadriceps & Hips. | **Cue:** Do not let front knee extend beyond toes.

Movement 2: Physioball Leg Curl

Target: Posterior Chain (Glutes/Hamstrings). | **Cue:** Keep glutes activated; do not drop hips.

Key Exercises: Power & Stability

Movement 1: Dumbbell Squat to Press

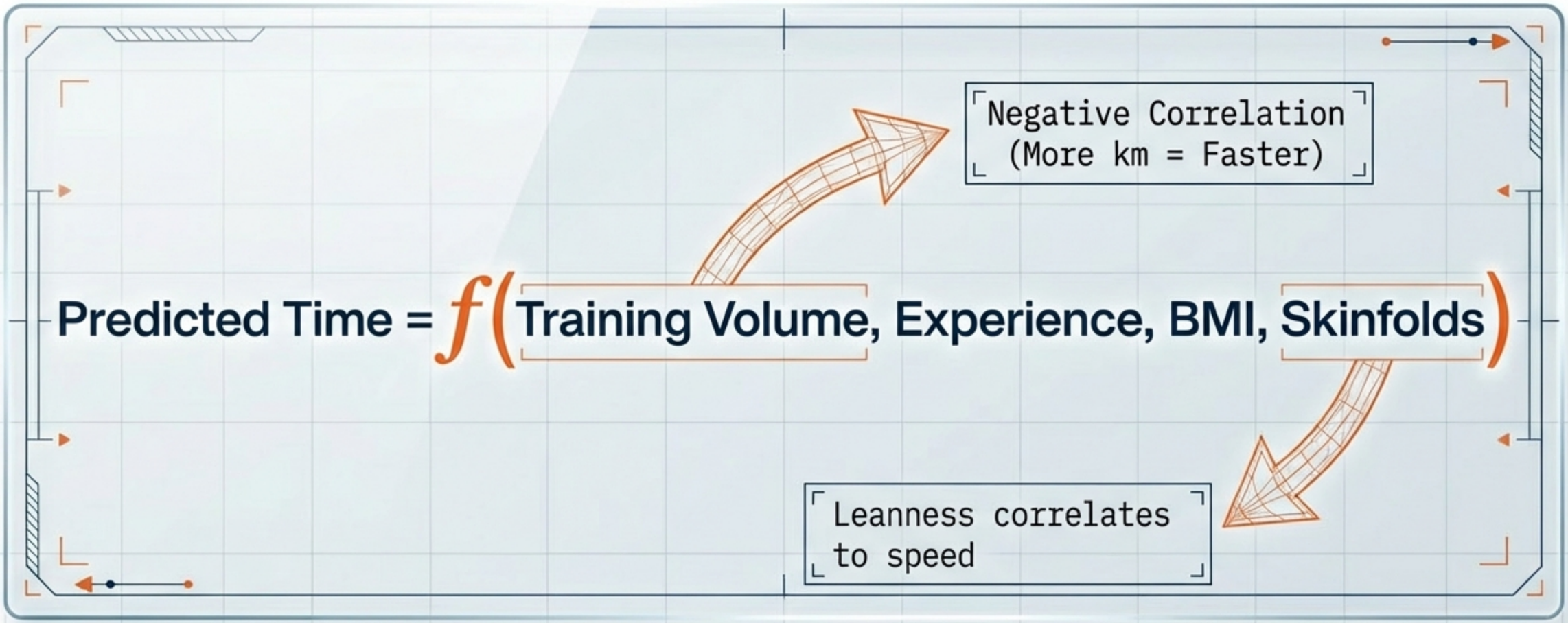
IBM Plex Mono
Target: Total Body Power. | Cue: Explode up using hips; transfer momentum overhead.

Movement 2: 1-Arm, 1-Leg Dumbbell Row

IBM Plex Mono
Target: Lats, Traps, Hip Stability. | Cue: Stabilize upper body. Counteracts the “tired slump” of fatigue.

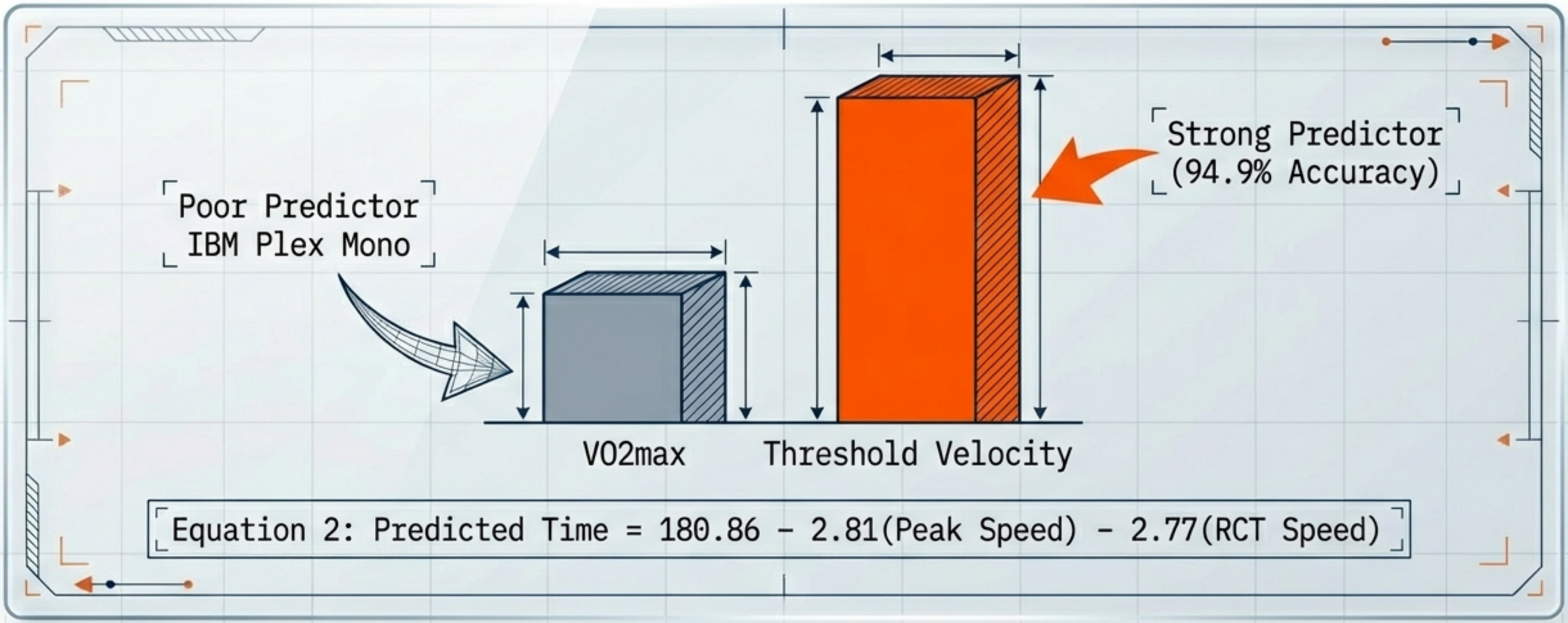
The Mathematics of Performance

Source: Journal of Sports Science and Medicine (2017)



Accuracy: 90.3%. Training volume and body composition provide the baseline prediction.

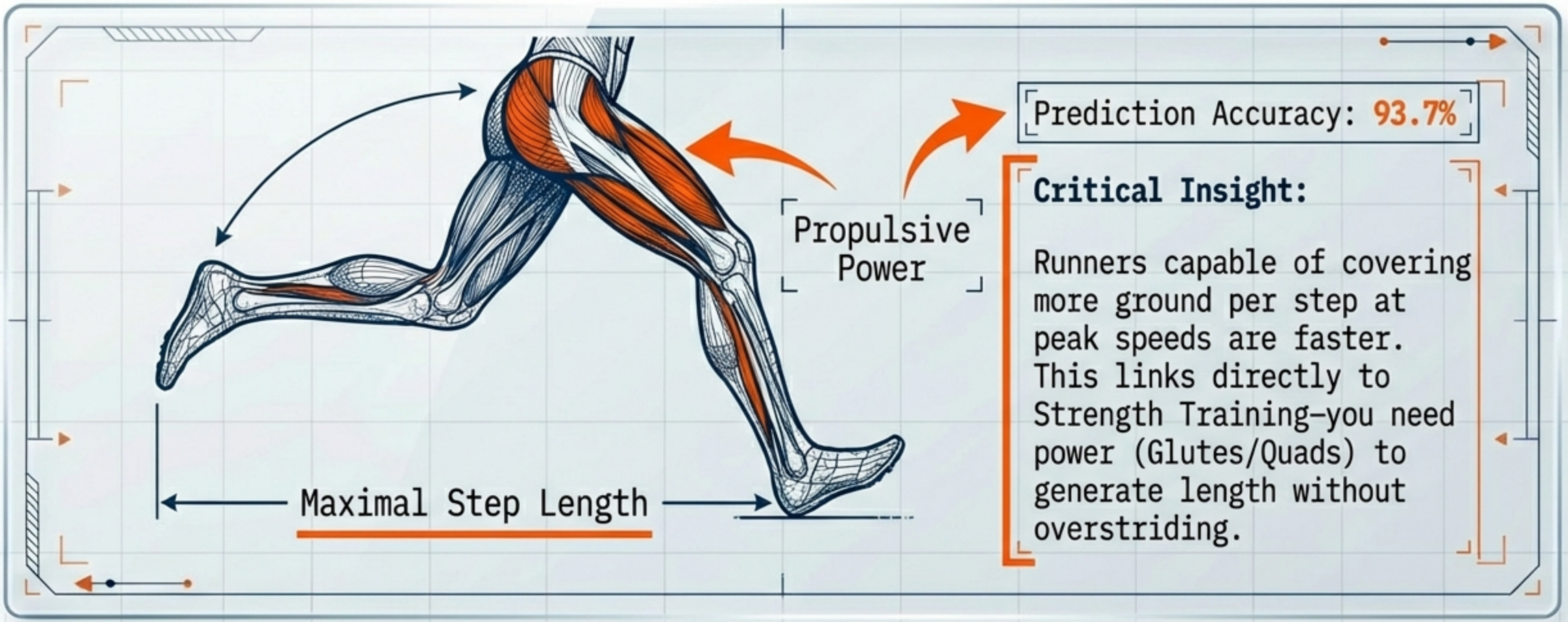
Velocity Over VO2max



Equation 2: Predicted Time = 180.86 – 2.81(Peak Speed) – 2.77(RCT Speed)

Insight: VO2max (lung capacity) matters less than the SPEED you can sustain at your threshold. Train to improve velocity (HIIT/Tempo), not just capacity.

The Biomechanical Link



Prediction Accuracy: **93.7%**

Critical Insight:

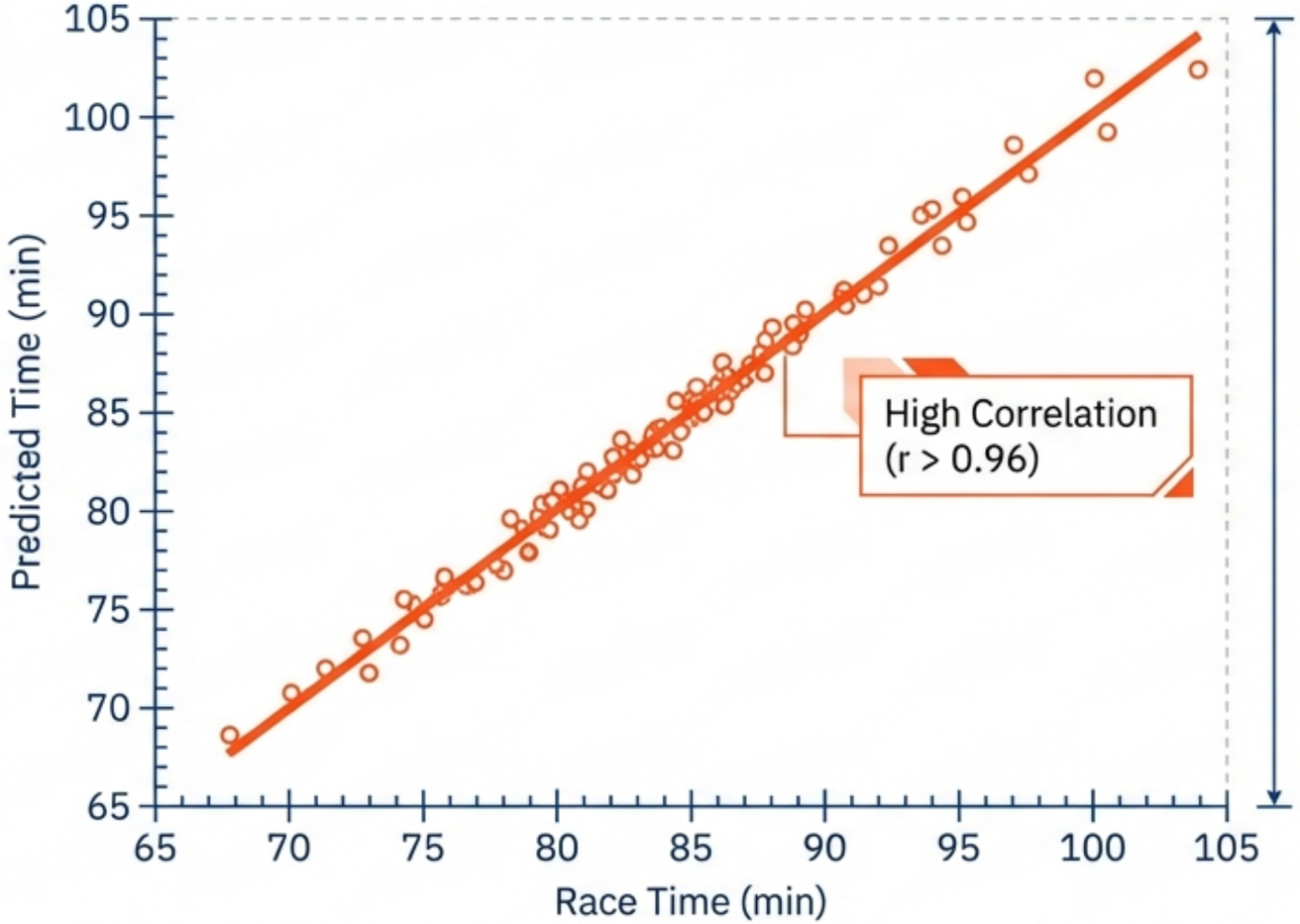
Runners capable of covering more ground per step at peak speeds are faster. This links directly to Strength Training—you need power (Glutes/Quads) to generate length without overstriding.

UNIT: MM

Source: Journal of Biomechanics (2022)

SCALE: 1:1

The Ultimate Predictor (96.2% Accuracy)



The General Equation

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Predicted Time = 169.54 − 2.51(Peak Speed)
− 2.25(RCT Speed) − 0.37(Years Experience)
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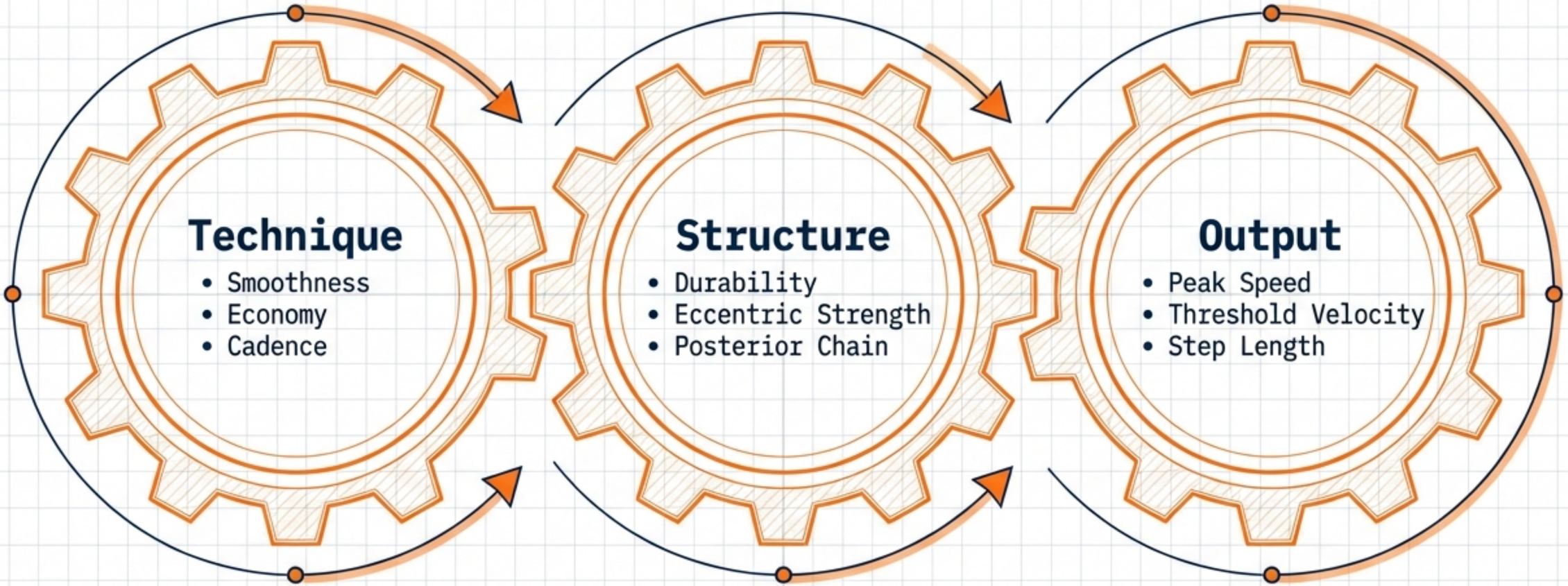
Experience Factor: Years of running allow an athlete to execute their physiological potential through pacing, pain tolerance, and efficiency.

UNIT: MIN | Source: Journal of Sports Sciences (2023) | SCALE: 1:1

The Integrated Athlete



Peak performance is an engineering puzzle. Optimize the mechanics, reinforce the chassis, and track the velocity output.

UNIT: N/A

Source: Integrated Sports Engineering Model (2024)

Conclusion

Performance is not random; it is engineered.
Evaluate your system. Identify the bottleneck. Optimize.