

## Components and Current Recommendations on Running Footwear



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KALAMAZOO | PORTAGE

## Thank You!

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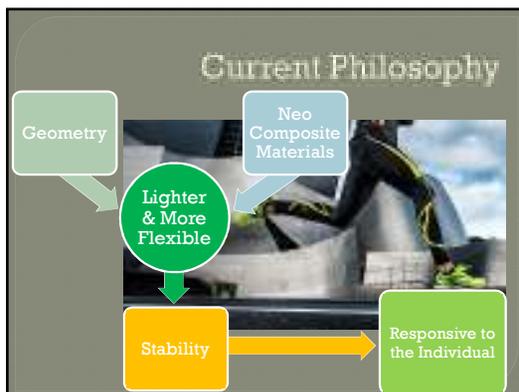




## Objectives



- Basic understanding of the components of running footwear
- The latest technology changes in materials
- Starting point for patient shoe recommendations



## Current Philosophy

THREE MAJOR CHANGES

- Upper
- Midsole
  - Materials
  - Geometry
- Outsole

SHOE ANATOMY



## Shoe Anatomy- Last

**Shape of the Last**  
 Goal: Shape of foot = Shape of the last

- 3 Curved
  - Spikes only
- 2 Semi-curved
  - Most common
- 1 Straight
  - Traditionally: Higher end motion control shoe
  - New age technology: Seeing this concept of inherent stability from geometry vs. additional materials prevalent across all traditional shoe categories (shoe genre)



### Shoe Anatomy- Last

#### Last Construction

##### Board

- Not in running shoes

##### Central Slip

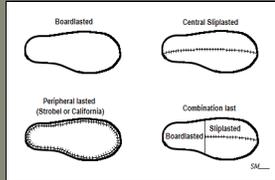
- Not used much

##### Peripheral Slip

- Most Common

##### Combination

- Also, not used much
  - Mostly one piece
  - Seen mostly in MC shoes



### Shoe Anatomy- Outsole

#### Shoe Outsole

##### Polyurethane

- Non-marking, more dense
- Not going to compress as easy

##### Blown or Gum Rubber

- Configuration dependent on manufacturer

##### High Density Carbon Rubber

- Decreased weight



### Shoe Anatomy- Outsole

#### Shoe Outsole

##### Improved technology going into outsole

- Very light-weight
- Very responsive
- No flat spots that allow the shoe to move with you (NB)

##### Integrated midsole & outsole

##### Midsole still present in others

- Adidas
- New Balance



### Shoe Anatomy- Midsole

#### Midsole Material

##### E.V.A. (Most common)

- Made in different densities
- Sheet cut
  - Lot of wasted material and more costly – not using much any more
- Compression molded
  - Almost everything now
  - More air in midsole to decrease weight



### Shoe Anatomy- Midsole

#### Midsole Material

##### Polyurethane

- Denser and heavier than E.V.A.
- Easier to shape
- Feels better
- No difference as far as shock absorption
- Better durability
- Watch for fake coloring



### Shoe Anatomy- Midsole

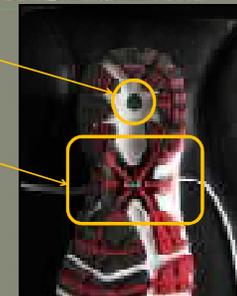
#### Midsole Additions

##### Cushioning units

- Air, Gel, Waves, Shocks, etc..
- Primarily marketing

##### Stabilizing units

- Different density midsole
  - Firmer under medial heel
- Plastic "footbridge"



### Shoe Anatomy- Midsole

Material Evolution in Running Shoes

The diagram consists of three overlapping boxes pointing to the right, representing the evolution of midsole materials. The first box is green and labeled 'Polyurethane'. The second box is blue and labeled 'EVA'. The third box is white with a grey border and labeled '"Neo Composites" (Mix of Foam & Rubbers)'. A large white arrow points from left to right behind the boxes.

### Shoe Anatomy- Midsole

Recent technology advancements in the midsole

- Materials
- Geometry
- Last shape
- Last profile

A side view of a running shoe with a vibrant, multi-colored midsole in shades of yellow, blue, and red. The shoe has a blue upper with yellow accents.

### Shoe Anatomy- Midsole

ASICS

- Midsole: Solyte®
- Rubberized foam
- Fluid Axis
  - Axis that follows the normal COM of normal foot biomechanics
- More flexible
- More natural

A person in a red shirt is running on a track. In the foreground, a large, detailed model of an ASICS shoe is shown, highlighting its midsole structure.

### Shoe Anatomy- Midsole

NIKE

Midsole: Lunar® Lunarlon compressed foam

- Changes in density medial and lateral
- To create a more dynamic response to amount of control needed

Phylon foam

- Increased duramer (stiffness)
- Casing of midsole

A cross-section of a Nike Lunarlon compressed foam midsole, showing its layered structure and varying densities.

### Shoe Anatomy- Midsole

NIKE

- Midsole: Lunar® 2014 Lunarlon compressed foam
- Advancements in the compression process
- Still have medial to lateral density changes
- Eliminated the Phylon foam casing

A close-up view of a Nike Lunarlon compressed foam midsole, showing its textured surface and layered construction.

### Midsole Materials

ADIDAS

- Midsole: Boost®
- Capsules of polyurethane
- Closed cell technology
  - No foam & No air
  - In theory= no breakdown

A dark, textured surface representing the Adidas Boost midsole material, which is composed of capsules of polyurethane.

### Shoe Anatomy- Midsole

#### NEW BALANCE

Midsole: RevLite®  
 Light-weight foam  
 (10% lighter than  
 Lunar®)  
 Utilizes a ground  
 contact EVA cradle  
 Stability created by  
 “pods” on both  
 medial and lateral  
 side



### Shoe Anatomy- Midsole

#### NEW BALANCE

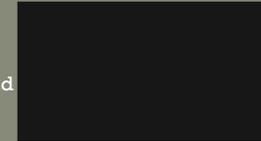
Midsole: Fresh Foam®  
 Similar to Lunar®  
 Change in  
 responsiveness early vs.  
 late in the race  
 Utilizes convex (medial  
 side) and concave  
 (lateral side) technology  
 to change support &  
 weight



### Shoe Anatomy- Midsole

#### BROOKS

Midsole: DNA and  
 Super DNA®  
 DNA encapsulated  
 midsole  
 Non-Newtonian liquid  
 Reacts to the  
 individual  
 Liquid to solid  
 properties



### Midsole Geometry

#### LAST SHAPE

More straight lasted vs.  
 traditional sculpted  
 Lighter without the need  
 for stability (plastic)  
 modules

#### LAST PROFILE

Medial & lateral out flare  
 Toe spring

**Stability  
 Through  
 Geometry**

### Midsole Geometry- Last

#### STRAIGHTER LASTING



#### TRADITIONAL SCULPTED



### Midsole Geometry- Profile

#### OUT FLARE



#### TOE SPRING



### Shoe Anatomy- Upper

Toe Box

- Length
- Width- Bunions, wide forefoot
- Depth – claw or hammertoes, thick forefoot posting
- All running shoe brands have all combinations
- Not all running shoe companies change the last width



Shoes that tend to run wider in toe box: New Balance; Brooks; Saucony

Narrower: Asics; Nike; Mizuno

### Shoe Anatomy- Upper

Engineered Mesh

- A skeletally engineered upper which is created by fusing a lightweight synthetic performance mesh with a thicker, supportive synthetic layer
- Tighter mesh = ↑ stability
- Looser mesh = ↑ relief (e.g., 1<sup>st</sup> MTP joint)
- Welds
  - Heat sealed
  - Eliminates stitching



### Shoe Anatomy- Upper

- Nike Flynit®
- NB Phantom Fit®
- Saucony Flex Film®



### Shoe Anatomy- Upper

Vamp

- Area where laces are placed
- Must be adequate for forefoot

Tongue

- Only in laced shoes
- May be tethered by flexible straps on tongue
- May become irritant if tongue slides to side



### Shoe Anatomy- Upper

Heel Counter

- Pressed Cardboard
  - More in racing shoe
  - Lightweight
  - Holds shape of shoe
- Thermoplastic
  - Most common in traditional shoes
  - Internal or external



### Shoe Anatomy- Insole

Insole

- Usually removable
- Makes accommodation of orthoses or other inserted pieces easier
- Function to protect foot from stitching ("sock liner")

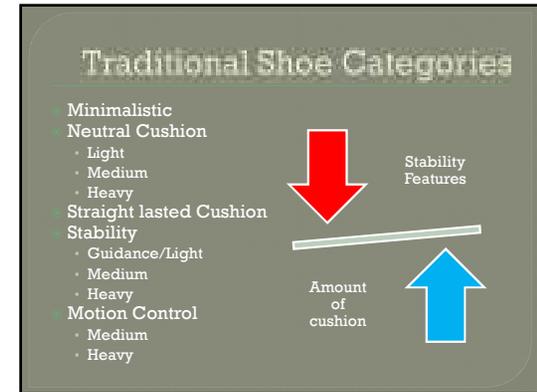




Traditional Shoe Categories

Where do we BEGIN??

Category	Sub-Category	Brand	Model	Weight	Drop	Stability	Cushion	Price
Minimalistic	Neutral Cushion	Asics	Minimalist	Light	10	Neutral	Light	\$100
			Minimalist	Medium	10	Neutral	Medium	\$100
			Minimalist	Heavy	10	Neutral	Heavy	\$100
			Minimalist	Heavy	10	Neutral	Heavy	\$100
Straight lasted Cushion	Stability	Asics	Guidance	Light	10	Mild	Light	\$100
			Guidance	Medium	10	Mild	Medium	\$100
			Guidance	Heavy	10	Mild	Heavy	\$100
			Guidance	Heavy	10	Mild	Heavy	\$100
Motion Control	Stability	Asics	Control	Medium	10	Strong	Medium	\$100
			Control	Medium	10	Strong	Medium	\$100
			Control	Medium	10	Strong	Medium	\$100
			Control	Medium	10	Strong	Medium	\$100



Traditional Shoe Categories

**Cushion/Neutral Shoe**  
 Sub-divided into Light, Medium and Heavy Cushion categories  
**Saucony ProGrid Ride**; Asics Cumulus; Brooks Ghost; Mizuno Wave Rider; Nike Pegasus

Traditional Shoe Categories

**Straight-Lasted Cushion Shoe**  
**Saucony Echelon**; Brooks Dyad; New Balance 840  
 Notes:  
 • Single density midsole with a more straight lasted shape  
 • Great for accommodating a custom orthoses or

Traditional Shoe Categories

**Guidance (Mild Stability) Shoe**  
**Saucony ProGrid Guide**; Asics DS Trainer; Brooks Ravenna; Mizuno Elixir; Nike Lunar Glide  
 Notes:  
 • Dual density midsole to provide increased stability with a more semi-curved lasted shape  
 • Essentially a cushion shoe with minimal posting

**Traditional Shoe Categories**

**Stability (Moderate) Shoe**  
**Saucony ProGrid Omni; Asics 2170; Brooks Adrenaline; Nike Structure Triax**  
**Notes:**

- Dual density materials that incorporate more of the midsole to provide increased stability with a more semi-curved lasted shape
- Earlier over-pronators



**Traditional Shoe Categories**

**Stability (Heavy) Shoe**  
**Saucony Hurricane; Asics Kayano; Brooks Trance; Mizuno; Wave Nirvana; Nike Lunar Eclipse**  
**Notes:**

- Heavier and for excessive over-pronation
- Small percentage of runners



**Traditional Shoe Categories**

**Motion Control Shoe**  
**Saucony Grid Stabil CS2; Asics Foundation; Brooks Beast; Mizuno Wave Alchemy**  
**Notes:**

- Heavier and for excessive over-pronation
- Small percentage of runners



**Traditional Shoe Categories**

**Racing Flat**  
**Saucony Grid Type A4 (3-5K)**  
**Notes:**

- For Race ONLY. Will train in other shoes
- Can be dual density (marathons)



**Traditional Shoe Categories**

**Trail Running Shoe**  
**Saucony Xodus 2.0**  
**Notes: More tear resistant and more durable outsole designed for unstable surface accommodation**



**Traditional Shoe Categories**

**Minimal Running Shoe**  
**Saucony ProGrid Mirage; Brooks "Pure" Line; Altra; New Balance Minimus; Saucony Kinvara; Nike Lunar Fly**  
**Notes:**

- For training initially to promote mid-foot/forefoot strike
- Can eventually be used as a "racing flat."



### Traditional Shoe Categories

Minimal Running Shoe  
Newton

Notes:

- Promotes Pose/Chi form
- Negative heel
- Concern = Flex point is through the midfoot versus metatarsal heads (normal mechanics)



### Traditional Shoe Categories

Minimal/Barefoot Running  
Vibram Five-Finger

Note: Not advised to start long distance running. Needs to be very slow progression....training to begin.



### Traditional Shoe Categories

Minimal/Barefoot Running  
Merrell Glove

Notes: No longer have to fit each toe into it's own compartment.

Almost every running shoe company now has there own version of a minimalist shoe



### Traditional Shoe Categories

Old Guy Shoes!!!  
Hoka All-Terrain and Road Shoes

- Mountain running or O.A.



### Shoe Recommendations

Based on plantar static foot type:  
Assigning shoe based on foot type does not decrease injury in Marine Corp Recruits (Knapik et al. 2010 *Am J Sports Med*)

*Only one piece of the puzzle!!*



### Shoe Recommendations

**The effect of three different levels of footwear stability on pain outcomes in women runners: a randomized control trial.** (Ryan et al. 2010 *British Journ of Sports Med*)

81 Women were categorized into 3 different foot posture types: neutral, pronated, highly pronated then randomly placed into 3 categories of shoe. (neutral, stability, or motion control)

**RESULTS:**

- 32% of the women missed training days over the course of the study.
- Motion control shoes "resulted in both a greater number of injured runners and missed training days than the other two shoe categories."
  - Motion control shoes faired very poorly.
  - The stability shoe reported the fewest missed days (51) and the motion control shoe (79) the most.

### Shoe Recommendations

### Shoe Recommendations

**When in Doubt???**

- If symptoms appear to be due to over-stabilization = Less shoe than current
- If symptoms appear to be due to under-stabilization = More shoe than current
- If not sure or symptom onset appears to be due to worn-out shoes (ascertained through running hx.) = Same shoe and proceed with caution

### Shoe Recommendations

**When to Replace Running Shoes??**

**Mileage**

- 15 years ago: 500-700 miles
- 5-7 years ago: 400-500 miles
- Last 2 years: 300-400 miles
- Consumer wants lighter shoe!

**Symptom onset**

- When their "pain" returns from a prior injury
- When the runner starts getting a little more sore than usual after a run

### Shoe Recommendations

**Other Considerations:**

- Two "different" feet
- Flexible forefoot / poor midfoot locking ability
- Ankle Dorsiflexion ROM or lack of TCJ mobility
- Late pronators or delayed resupinators
- Shoes for training & shoes for gait retraining

### You Will Make Mistakes!

### Contact Info