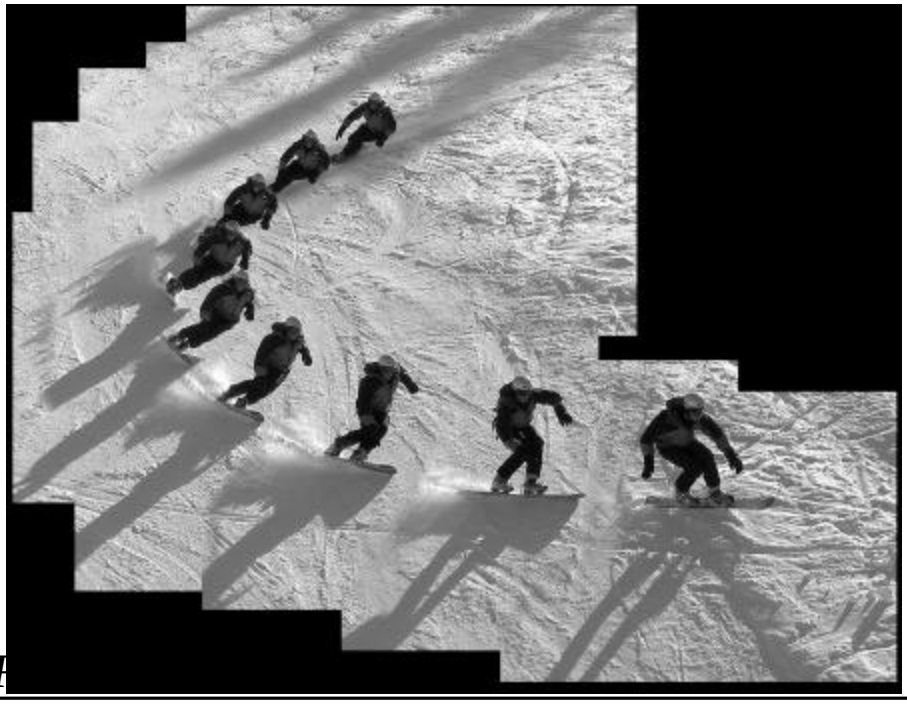


The Text Book

My Approach

- Look carefully at the best skiers
- Distill what is common
- Seek an explanation for why it works

Technique and Methodology

- Technique
  - The movements that the athlete makes, as described objectively by an external observer
  - This is *not* what you teach
- Methodology
  - The information presented to the athlete with the intention of eliciting the desired behavior
  - Usually subjective in nature (kinesthetic, visual, emotional)

The Rider's Objective

- Control speed
- Control direction
- In other words, control *velocity*

Fundamental Mechanics

Center of Mass

Hips and CM

- The CM is not usually in the rider's hips

Methodology and Technique

- Teaching method
  - "Keep your hips over your feet."
- Technique
  - "Keep your center of gravity over your feet."

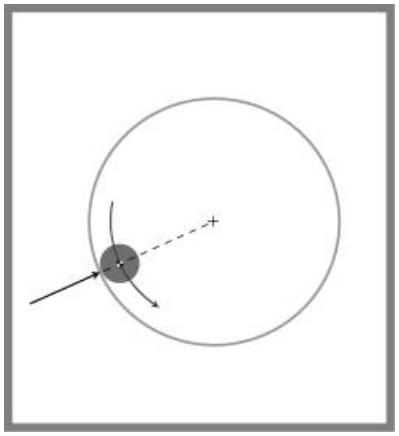
Line of Motion

- The path followed by the skier's CM
- At every point in time, it points in the direction of the skier's momentum

Force

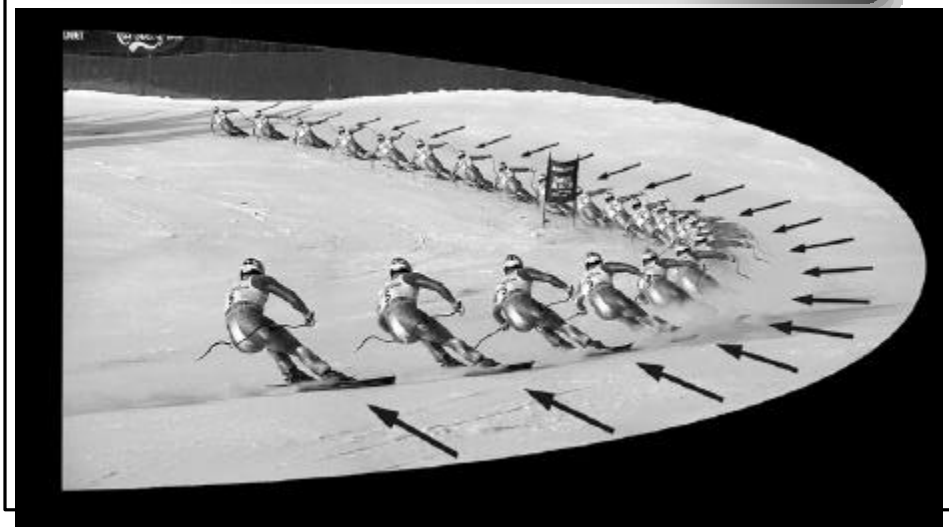
- A push or a pull
- Something that causes a change in the motion of a body
- Has two parts
  - Magnitude
  - Direction
- Force is related to pressure, but not the same thing
- Is centrifugal force *really* a force?
- Ski/snow friction causes linear deceleration only.

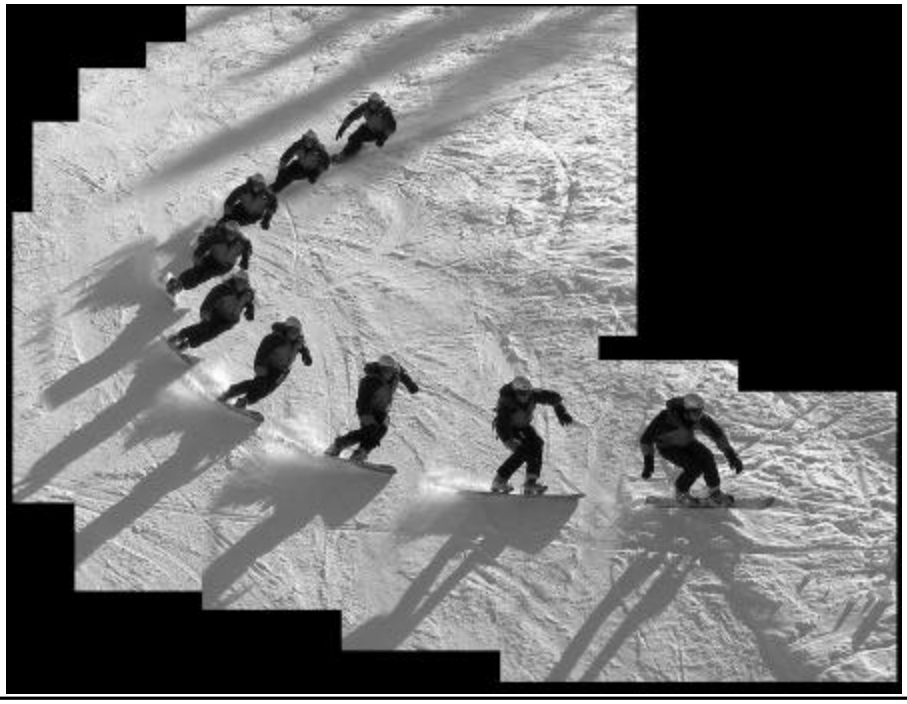
How Things Turn



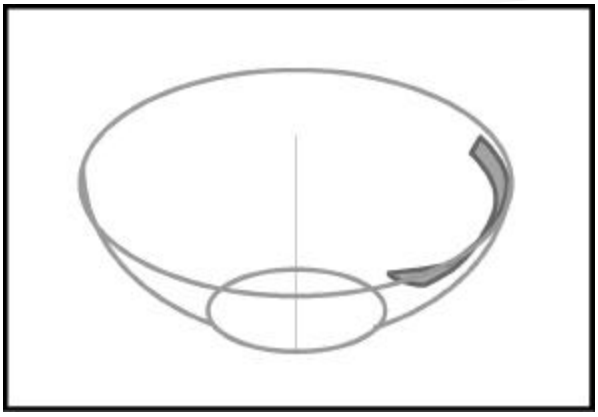
- The ball undergoes *radial* acceleration
- Where does the force come from?

The Snow Turns the Rider





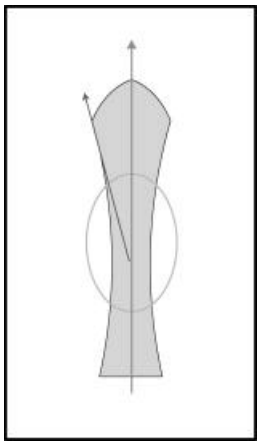
How a Board Carves an Arc



Steering Angle

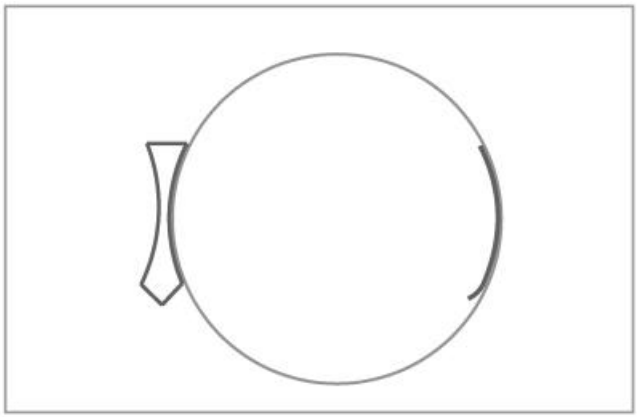
- The angle between the mid-body of the board and your line of motion
- To change your line of motion, the board must have a steering angle
- The board's sidecut gives it built-in steering angles

Self-Steering Effect

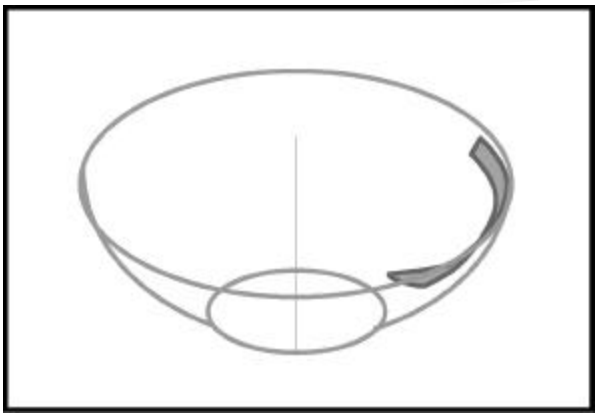


- First, the board must turn. Then, *you* turn.
- The middle of the board makes *you* turn
- The tip and tail make the board turn
- The board cuts a groove in the snow like the inside of the bowl

Sidecut vs Reverse Camber



How Can We Tighten the Arc?

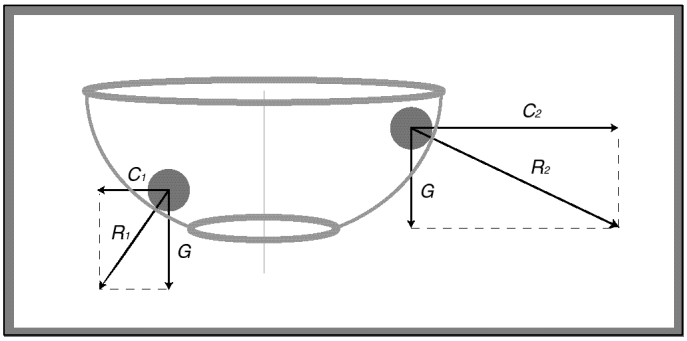


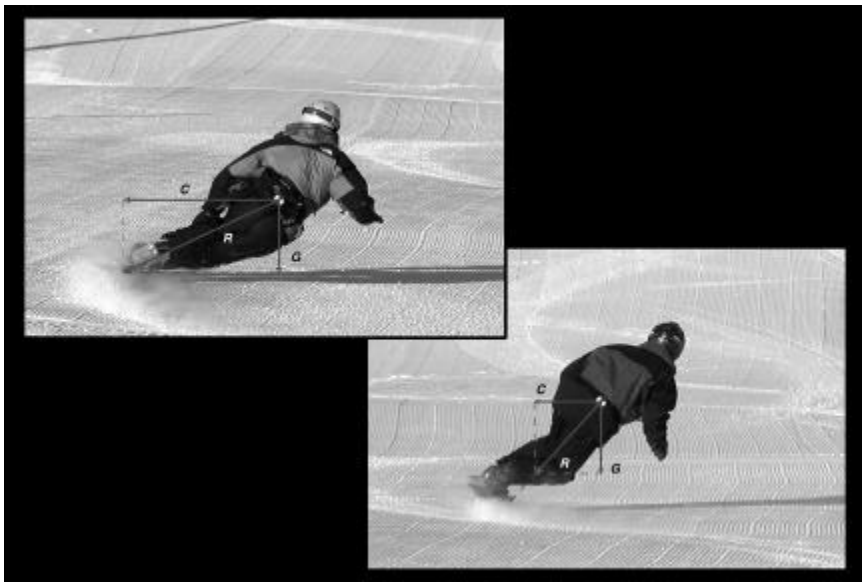
Inclination

Inclination

- Gravity and centrifugal force combine to form the resultant force on the rider
- The amount of inclination needed in a given turn is dictated by the direction of the resultant

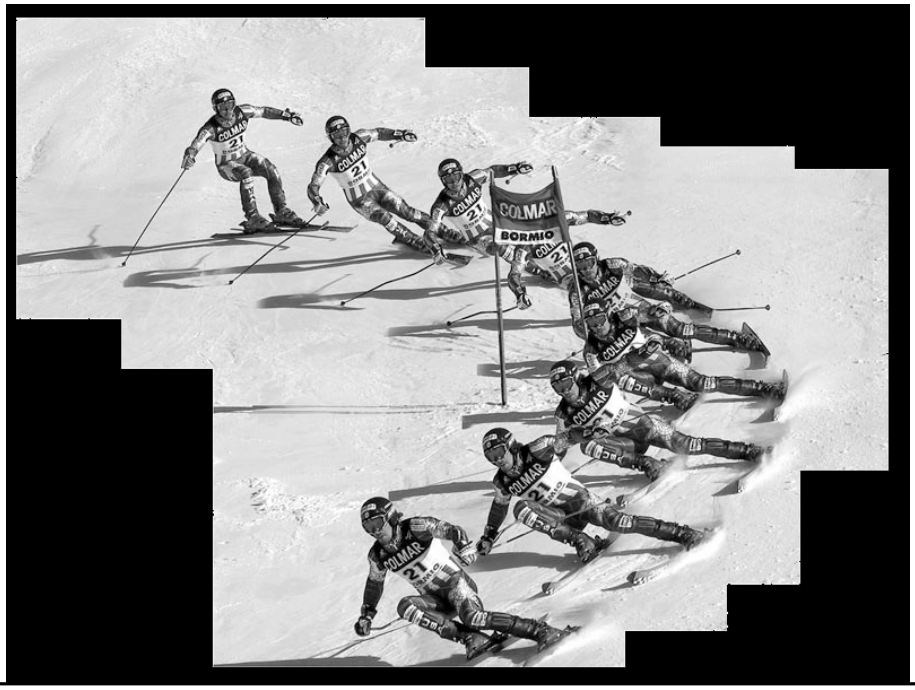
Inclination

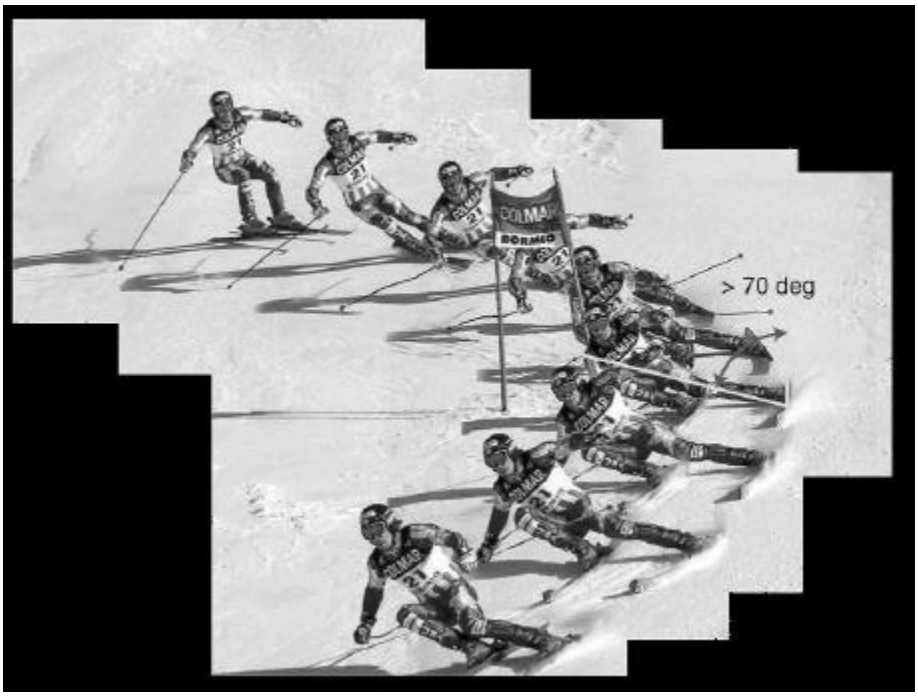




Inclination

- As newer equipment holds better, the rider must balance against larger forces, requiring
  - More inclination
  - Better physical conditioning





Fundamental Movements

- How the rider affects the board's control parameters
  - Up and down
  - Fore and aft
  - Edging
  - Pivoting
  - Balancing laterally

Fundamental Movements

- The rider makes them to for different reasons
- Therefore, the rider should be able to make them independently
- The technically sophisticated and subtle rider can mix and match the movements to fit the situation.

Balance and Transition

Balance

- There are two types of balance
  - Static
  - Dynamic
  - The terms are commonly misused by instructors
- A boarder is rarely in static balance, and never in dynamic balance when riding
- Riding is like a broom balanced on your hand

Transition

- In a turn, the rider's feet must follow a longer path than the CM
- Path of CM and path of feet must cross between turns
- Cross-over vs. cross-under
  - Difference is perceptual, not mechanical

Transition

- The crucial move in snowboarding
- The beginning snowboarder must learn skills that advanced for a skier
  - Timing the moment of edge change
  - Controlled toppling
  - Estimation of anticipated force

Transition Mechanics

- Board tightens its arc, so CM “falls to the outside”
- Feet and board slow down, e.g. via an edge-set, and CM topples across the feet
- By relaxing key muscles, upper body disengages from feet and its momentum carries it across

Edgeset

Skis Tighten the Arc

Flexion

Swapping Sides

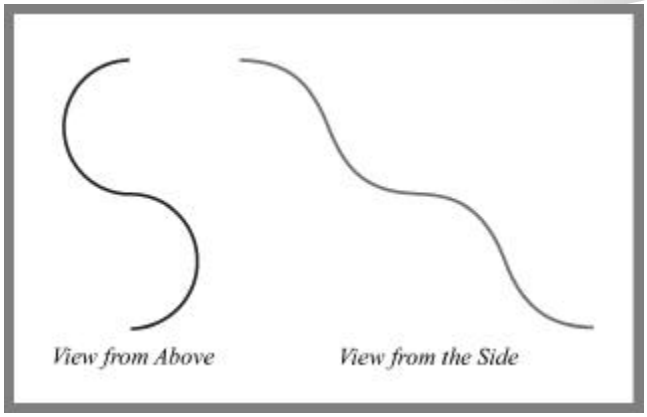
Methodology and Technique

- Teaching Method
  - "Project your center of mass down the hill."
- Technique
  - "Put your body out of balance so your line of motion crosses the path of your feet."

The Virtual Bump

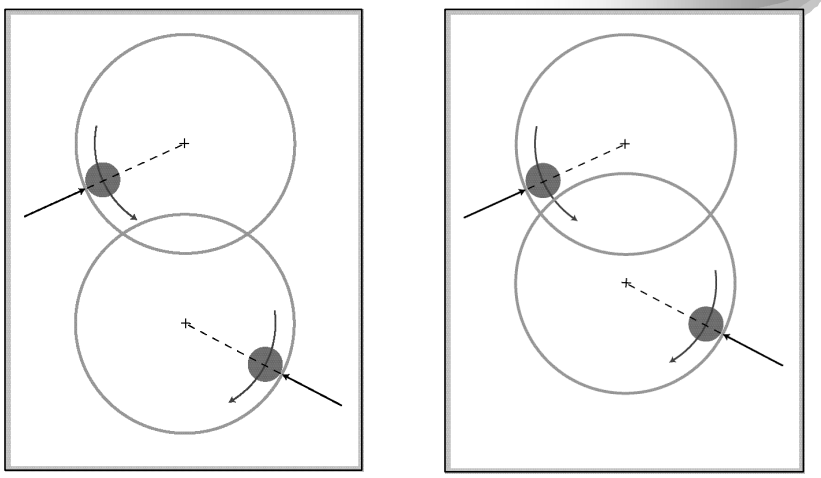
- Even on a smooth slope, turning creates a bump by
  - Going in and out of the fall line
  - The path of the upper body crossing over that of the feet

The Virtual Bump



The Virtual Bump

Redirecting the Board



Turning the Board

- Rotation
  - Board must be engaged in the snow, then disengaged
- Counter-rotation
  - Board must be free of the snow
- Differential slipping
  - Pressure must be shifted toward one end of the board

Rotation

Rotation and Counter-Rotation

Thanks for Coming!