

# Fixed-Point Belaying

Derek DeBruin

Thanks to Jesse Williams, Chris Burk, Petzl America



Austin Schmitz on "Lost in Space" in Linville Gorge, North Carolina.

Photo: Tate Peterson.

# The Problem

- “Fall Factor 2”
- i.e. Difficult climbing on steep terrain immediately above the belay anchor, increasing the probability of a fall directly onto the belay prior to placing the first piece of protection on the pitch

# Solutions?

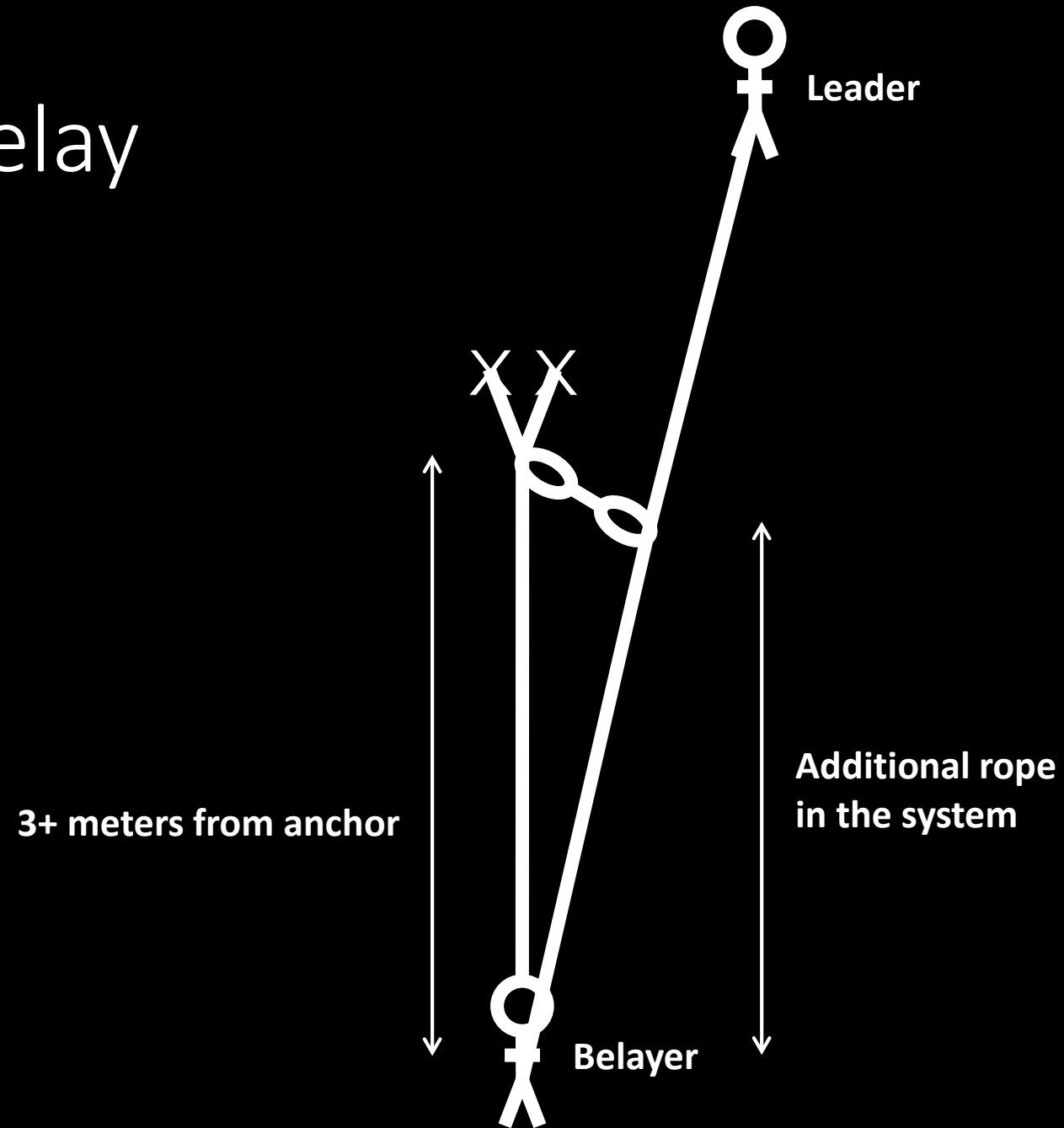
1. Relocate anchor
2. Chariot belay
3. Pre-clip first piece
4. Redirect on the anchor
5. Fixed-point belay

# 1. Relocate the Belay

- Must have the gear to do so
- Probably more useful if not onsighting
- Not always possible on steep routes with fixed anchors



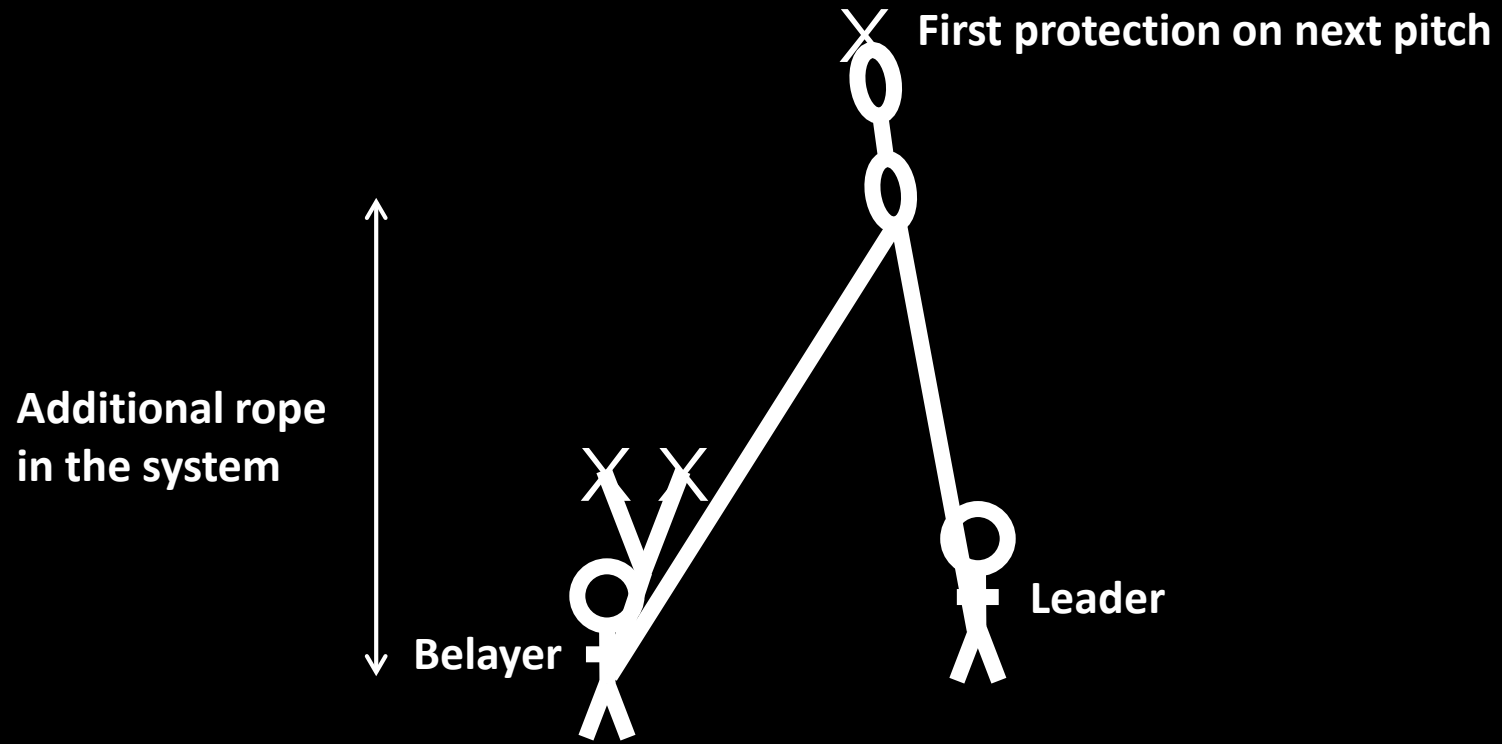
## 2. Chariot Belay



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- Belayer displacement?
- Belayer security at start of their turn to climb
  - Can belayer secure themselves?
  - Security from above requires lots of rope

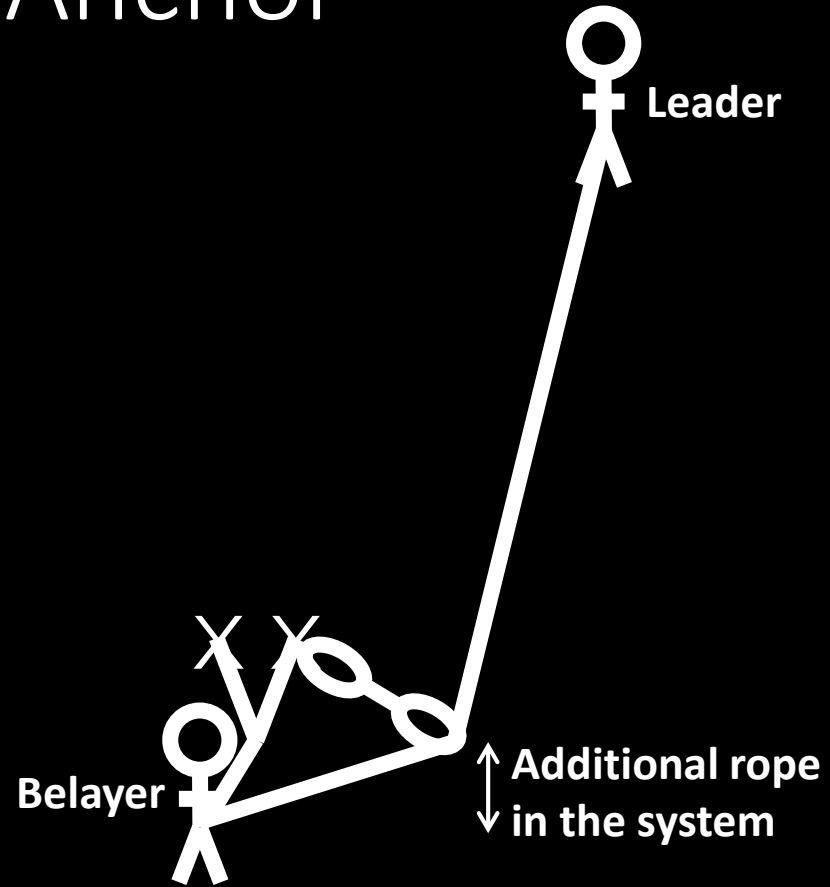
# 3. Pre-Clip First Piece



### 3. Pre-Clip First Piece

- Need sufficient rope on preceding pitch
- Need right gear for first piece and a solid anchor
- Leader must downclimb or lower back to anchor
- Potentially long distance from belayer w/difficult moves
- Belayer displacement?
- Swapping leads more complex (untie, etc.)

# 4. Redirect on the Anchor

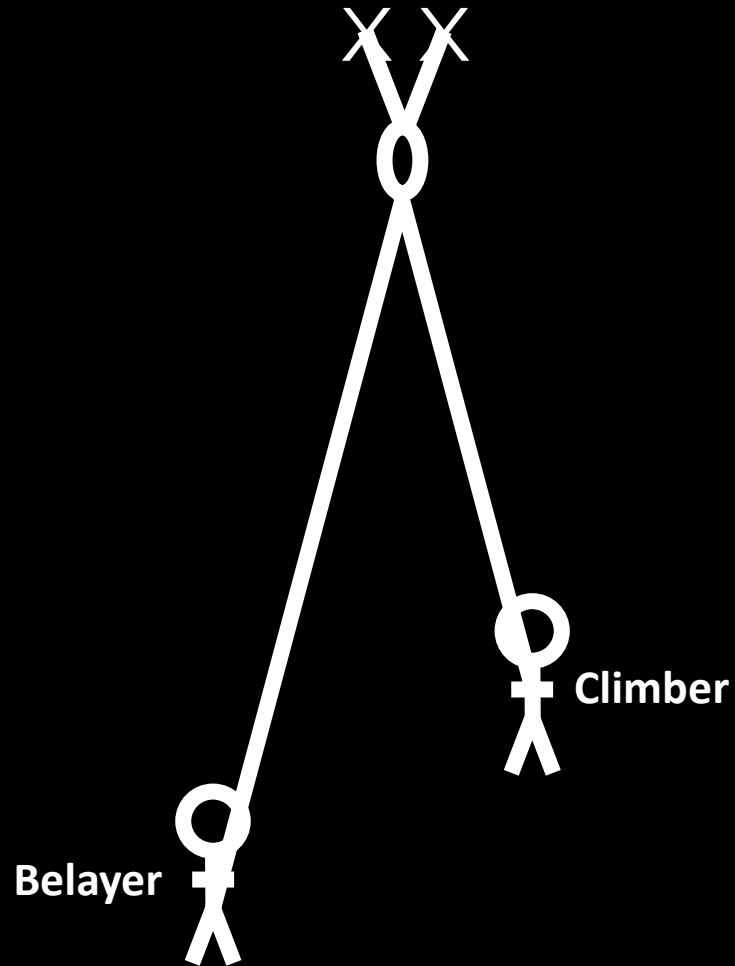


# 4. Redirect on the Anchor

- Familiar to most climbers
- Belayer displacement!
- Pulley effect!!!

# 4. Redirect on the Anchor: Pulley Effect

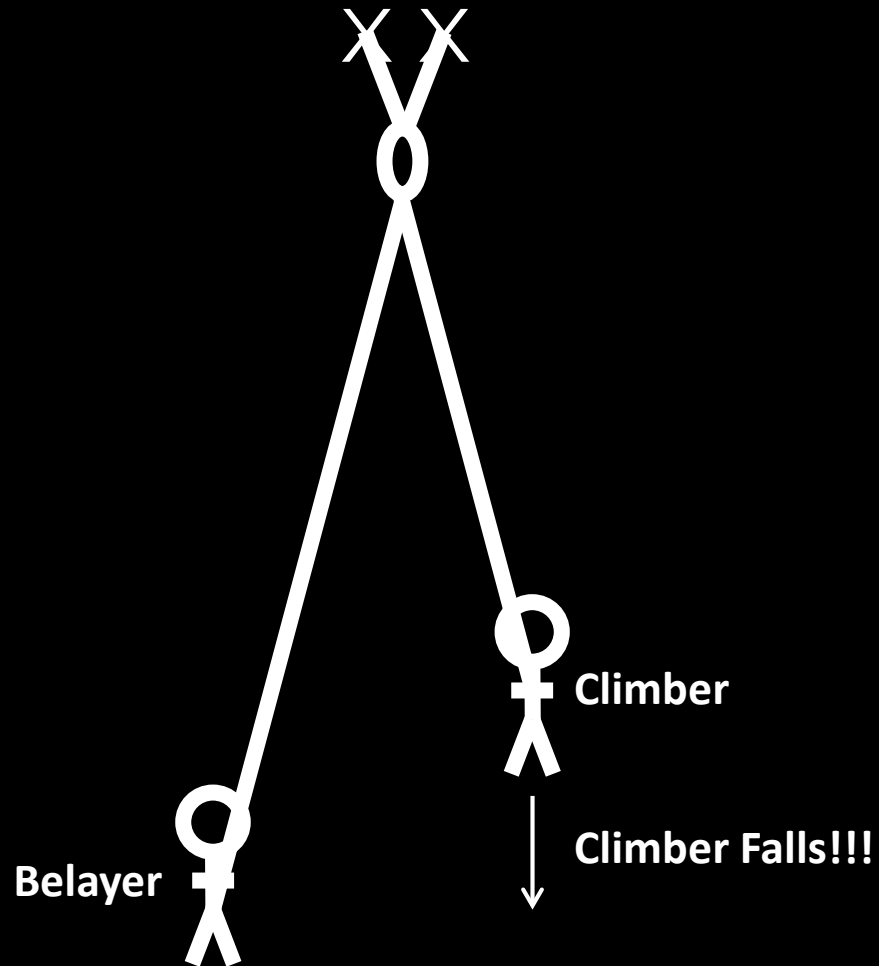
- Let's go top roping...





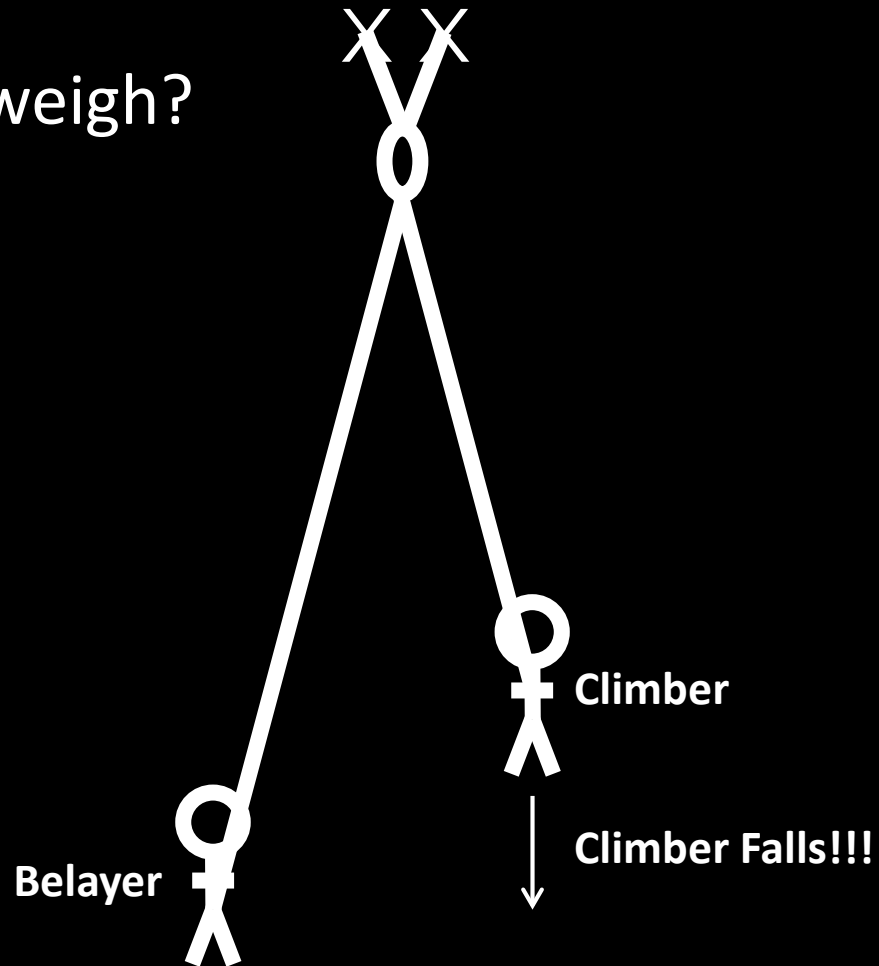
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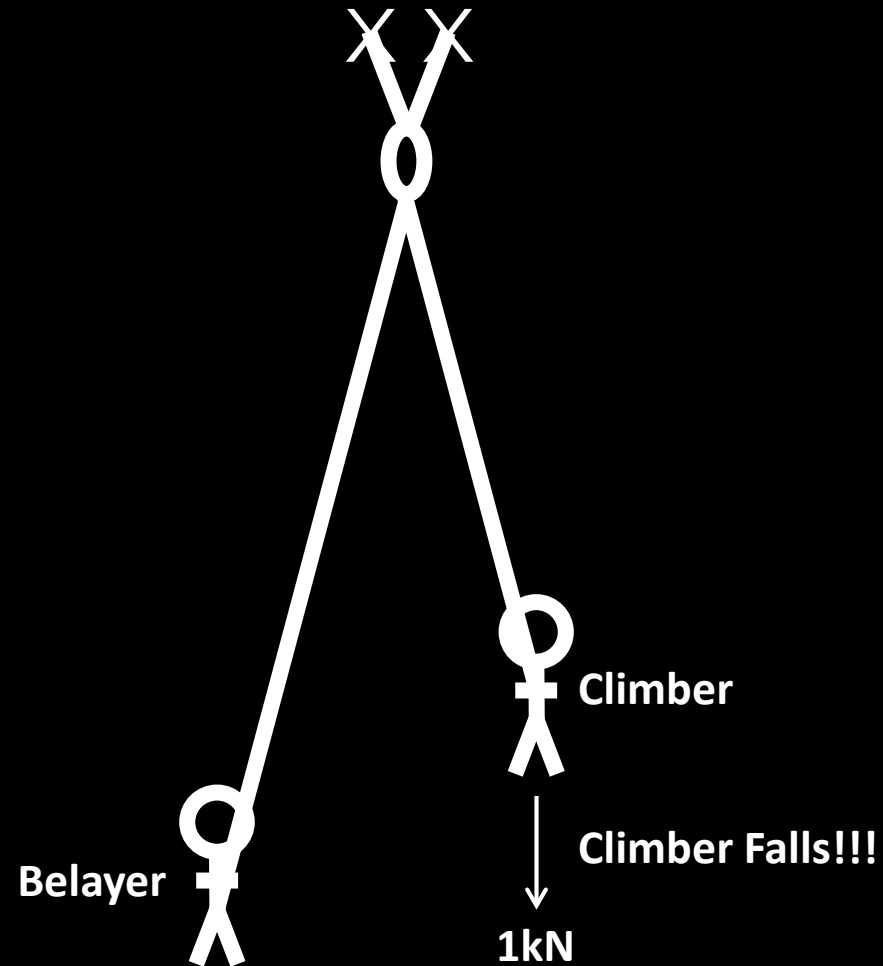
# 4. Redirect on the Anchor: Pulley Effect

- How much does a climber weigh?



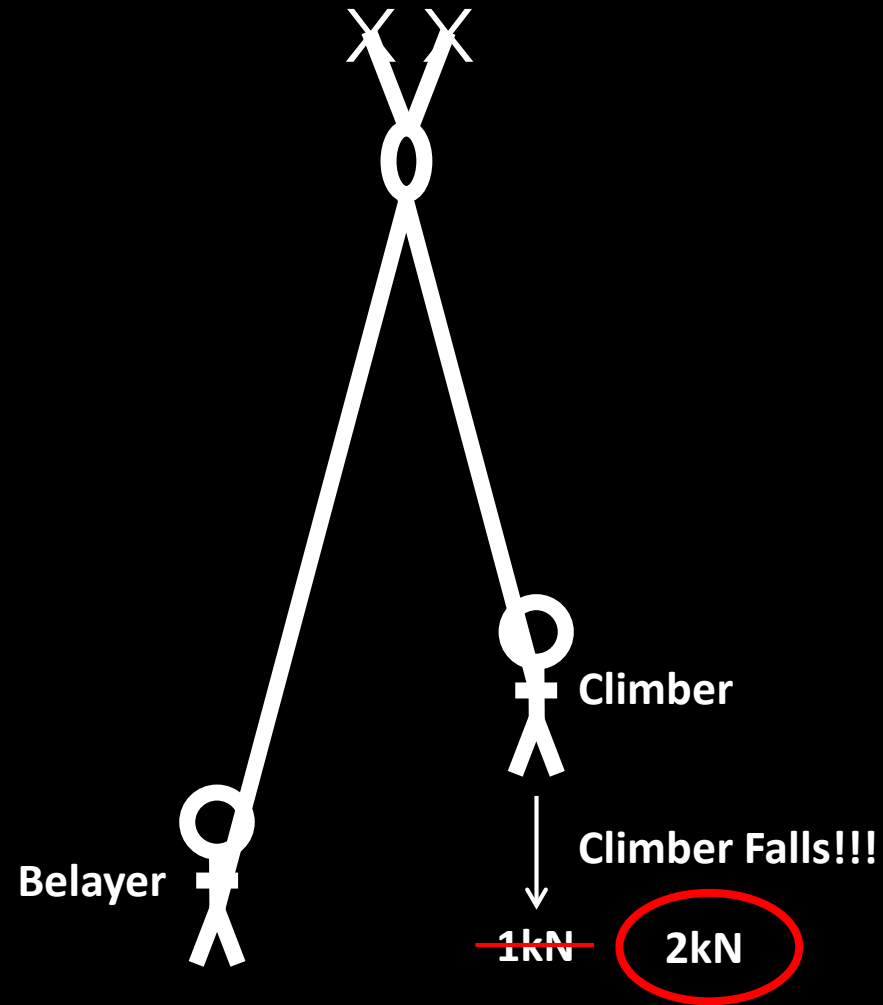
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- 1kN ~ 224.5lbf



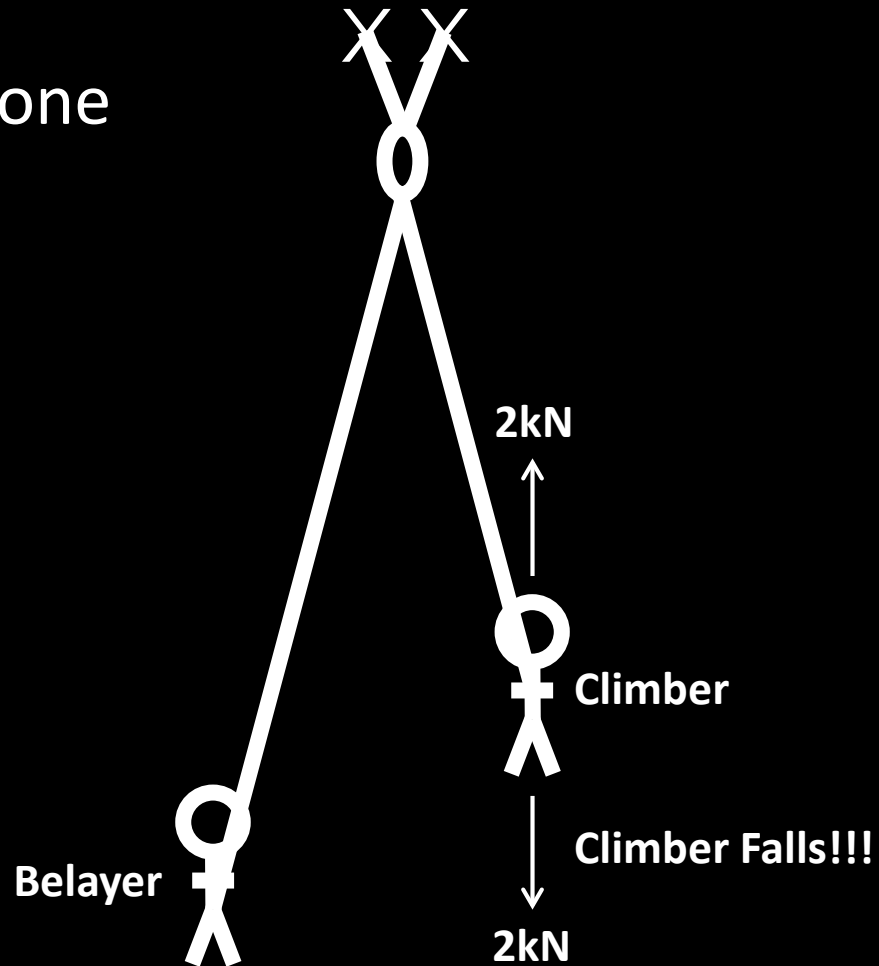
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- What about acceleration?



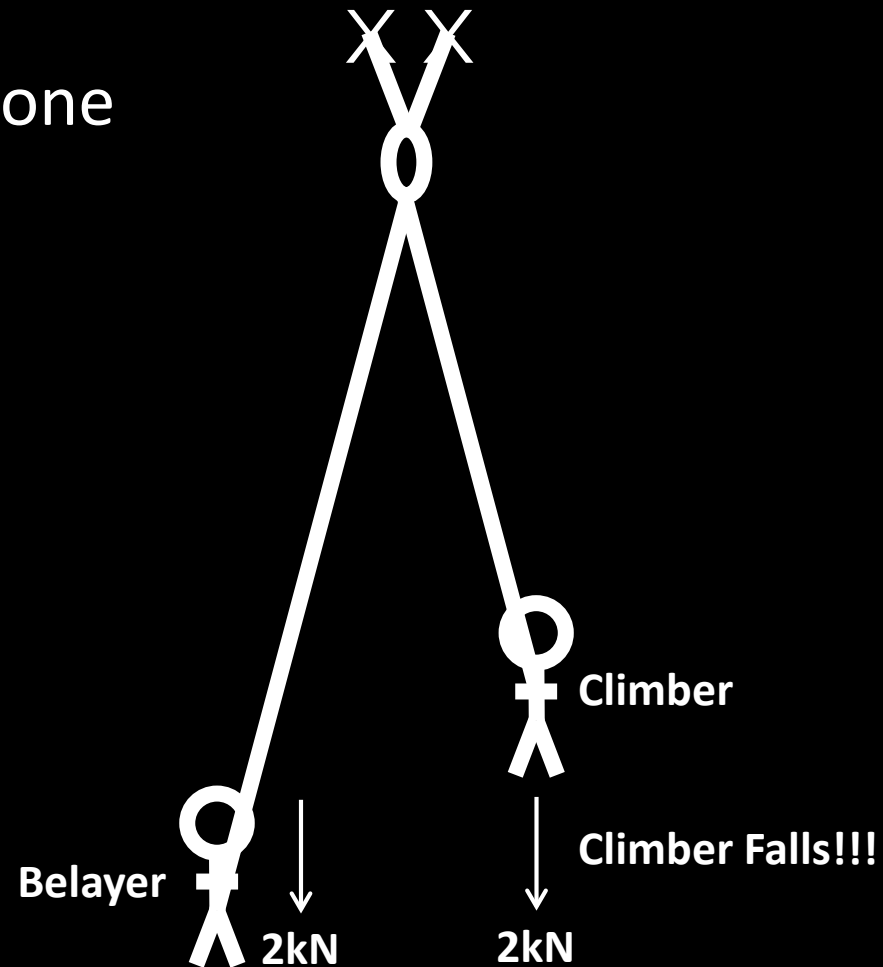
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- Rope translates force from one end to the other



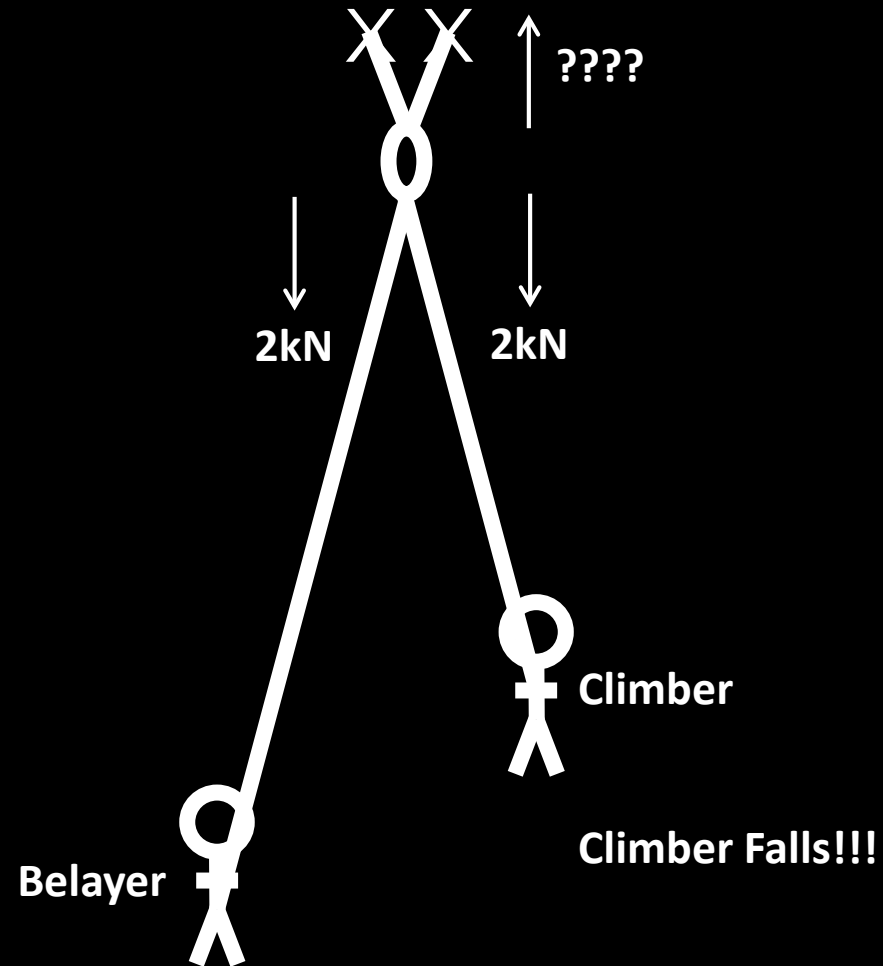
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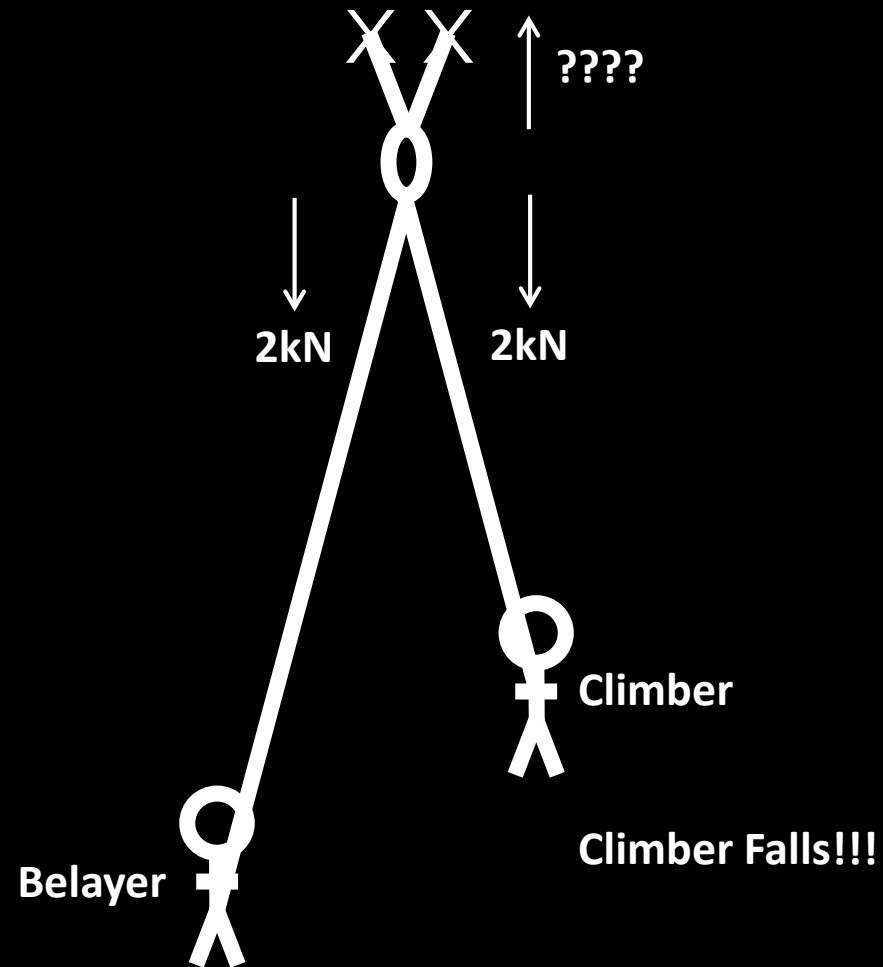
- Force on the anchor is...?



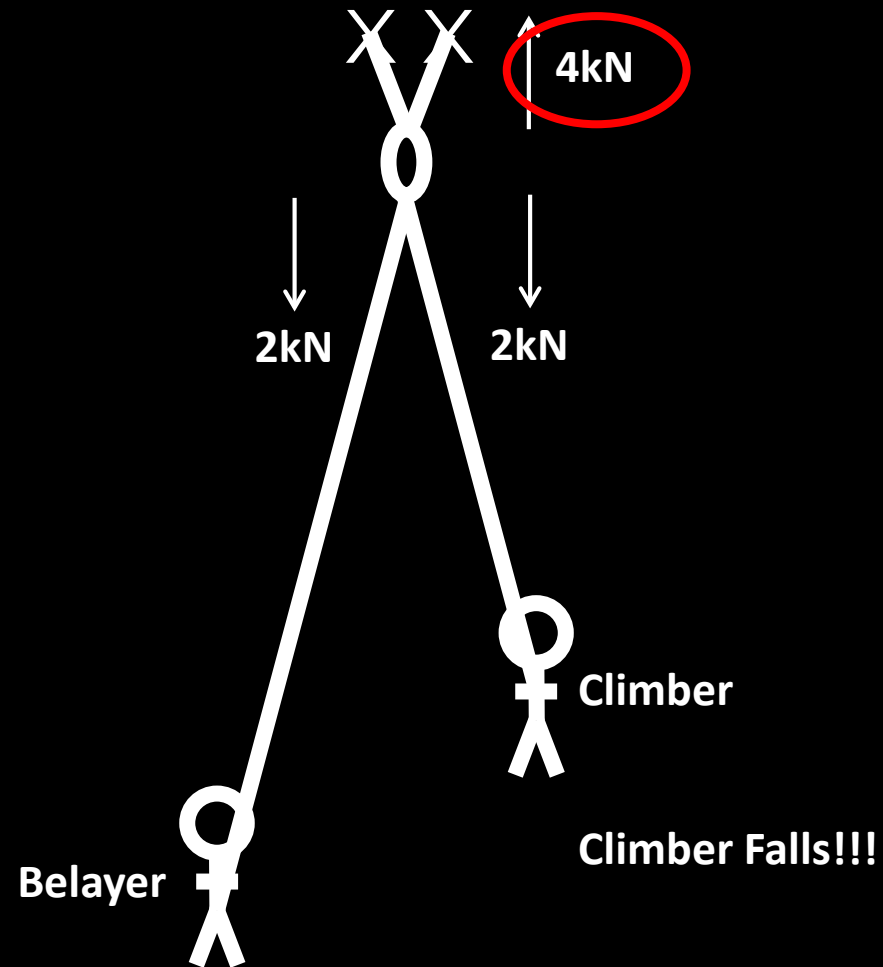


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- Force on the anchor is...?
- $2 + 2 = \dots$

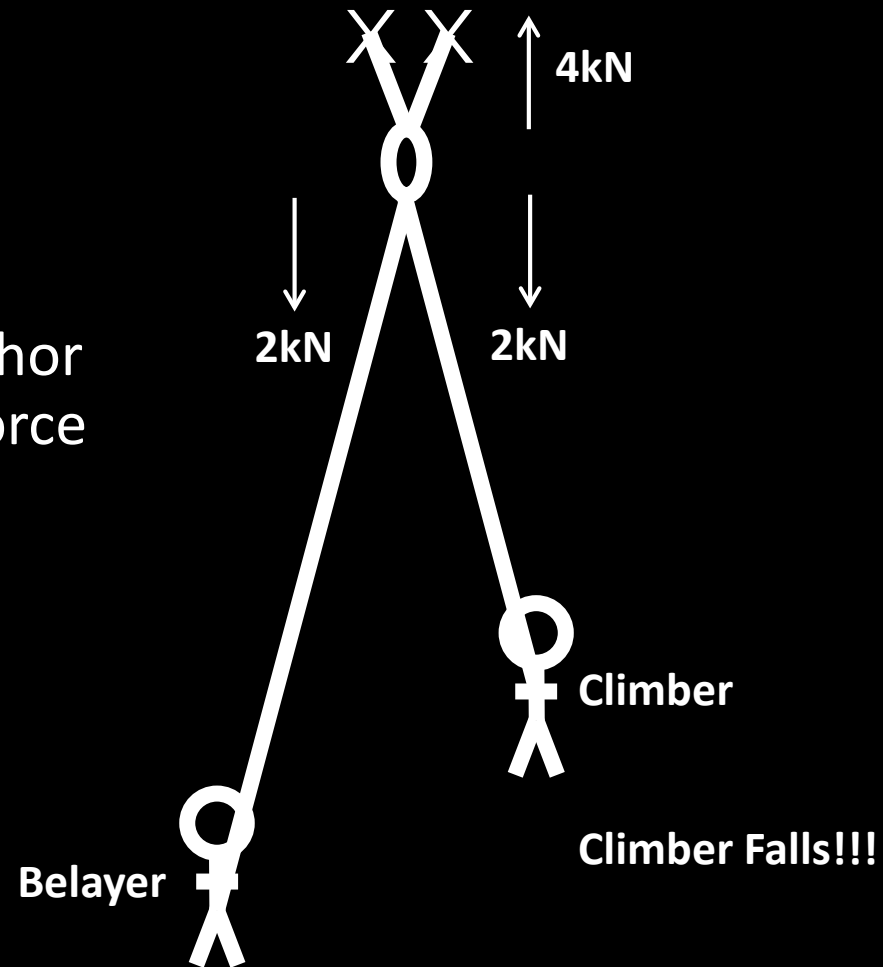


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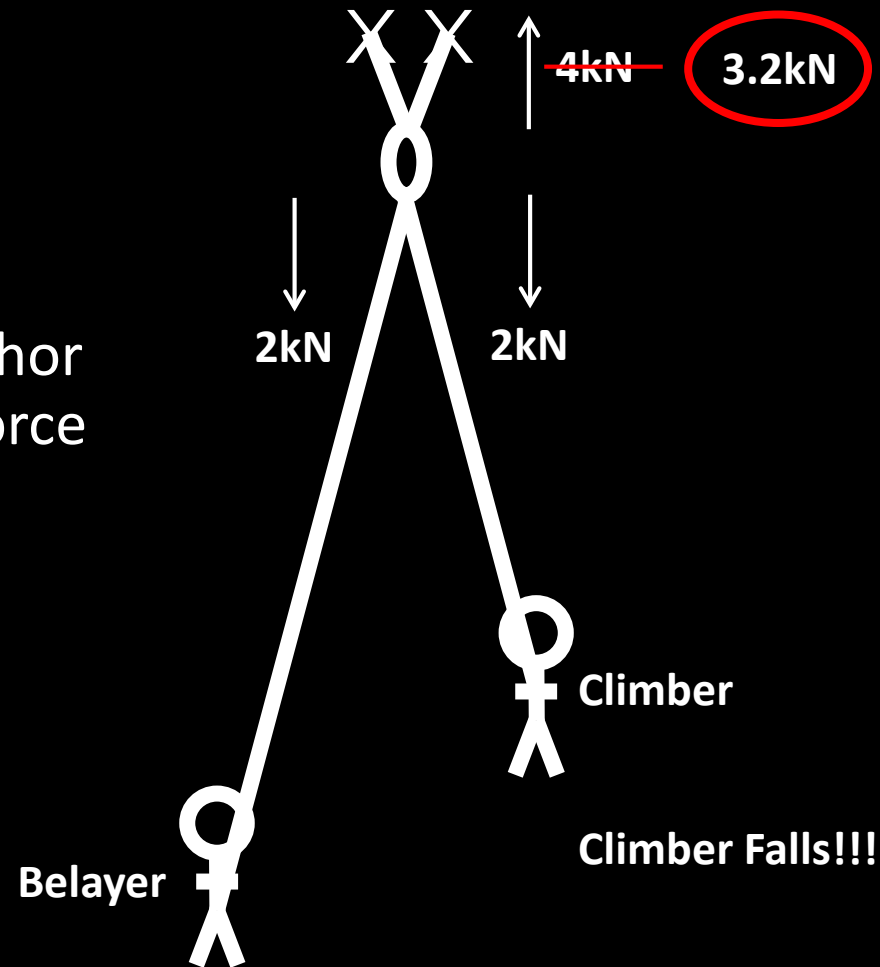
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- Caveats:
  - Climbers might be >225lb
  - Rope might not be taut
  - Friction means force on anchor is 1.6 times (NOT 2 times) force on climber



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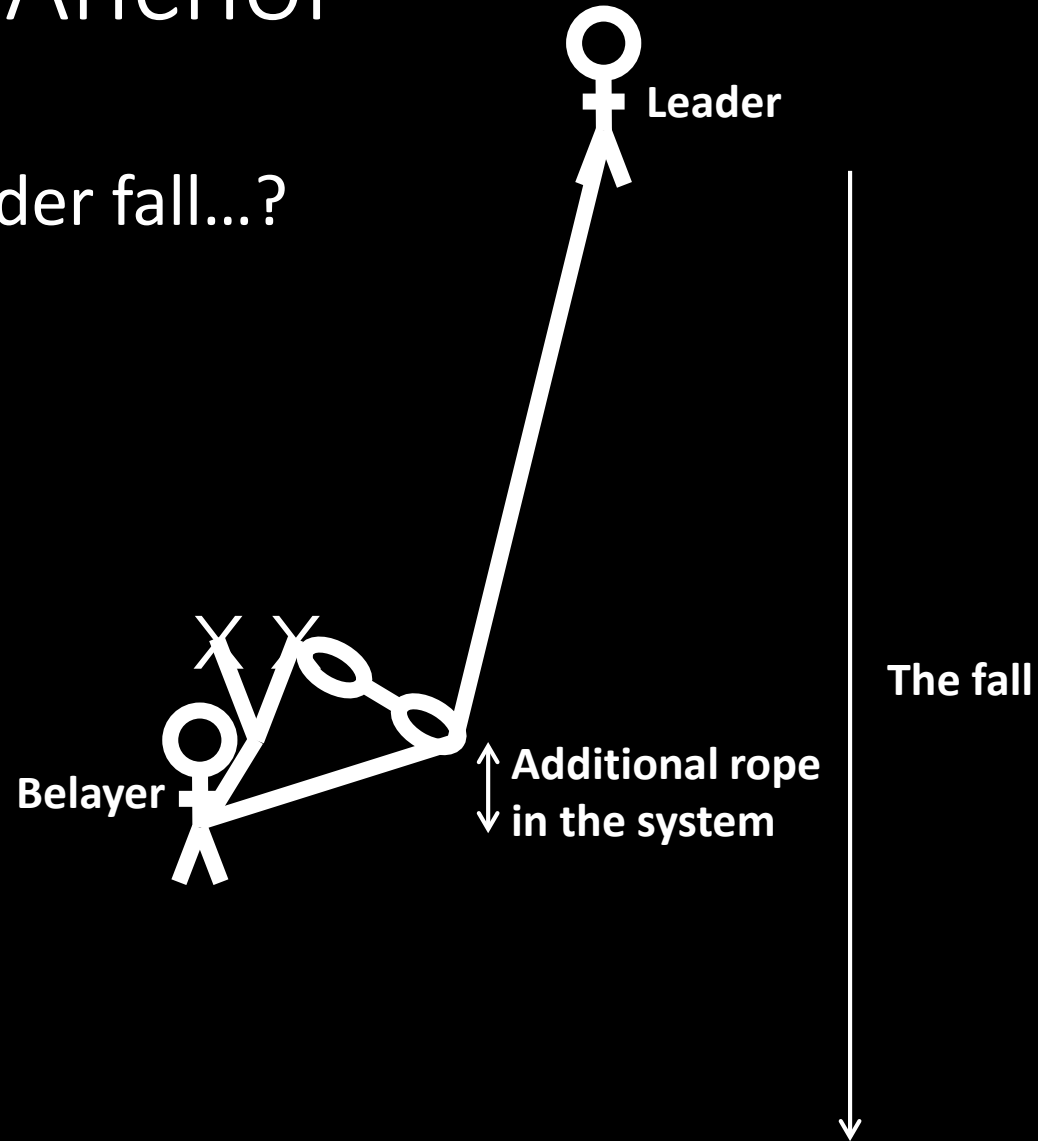


## 4. Redirect on the Anchor: Pulley Effect

- Punchline: force gets doubled, give or take

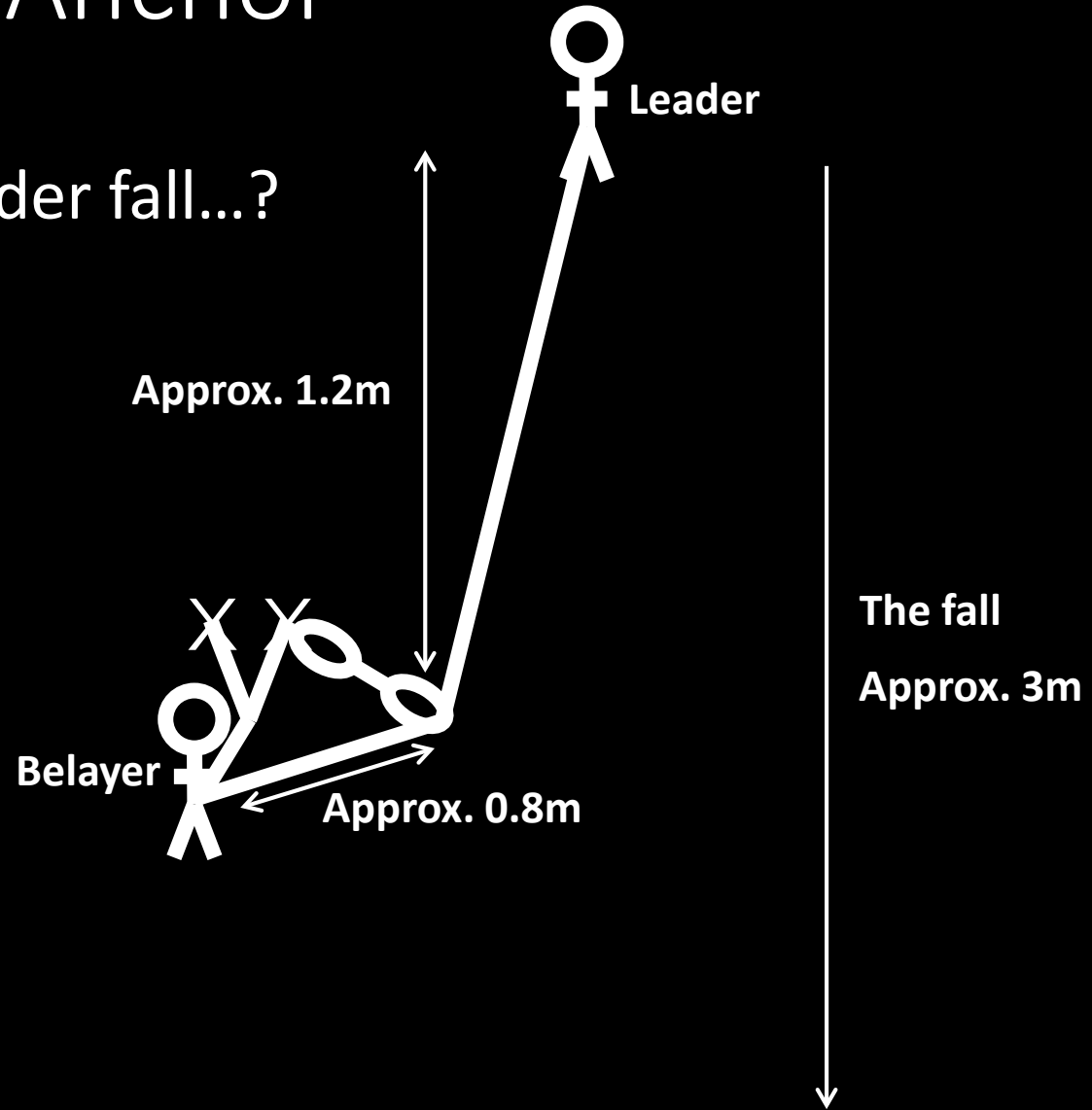
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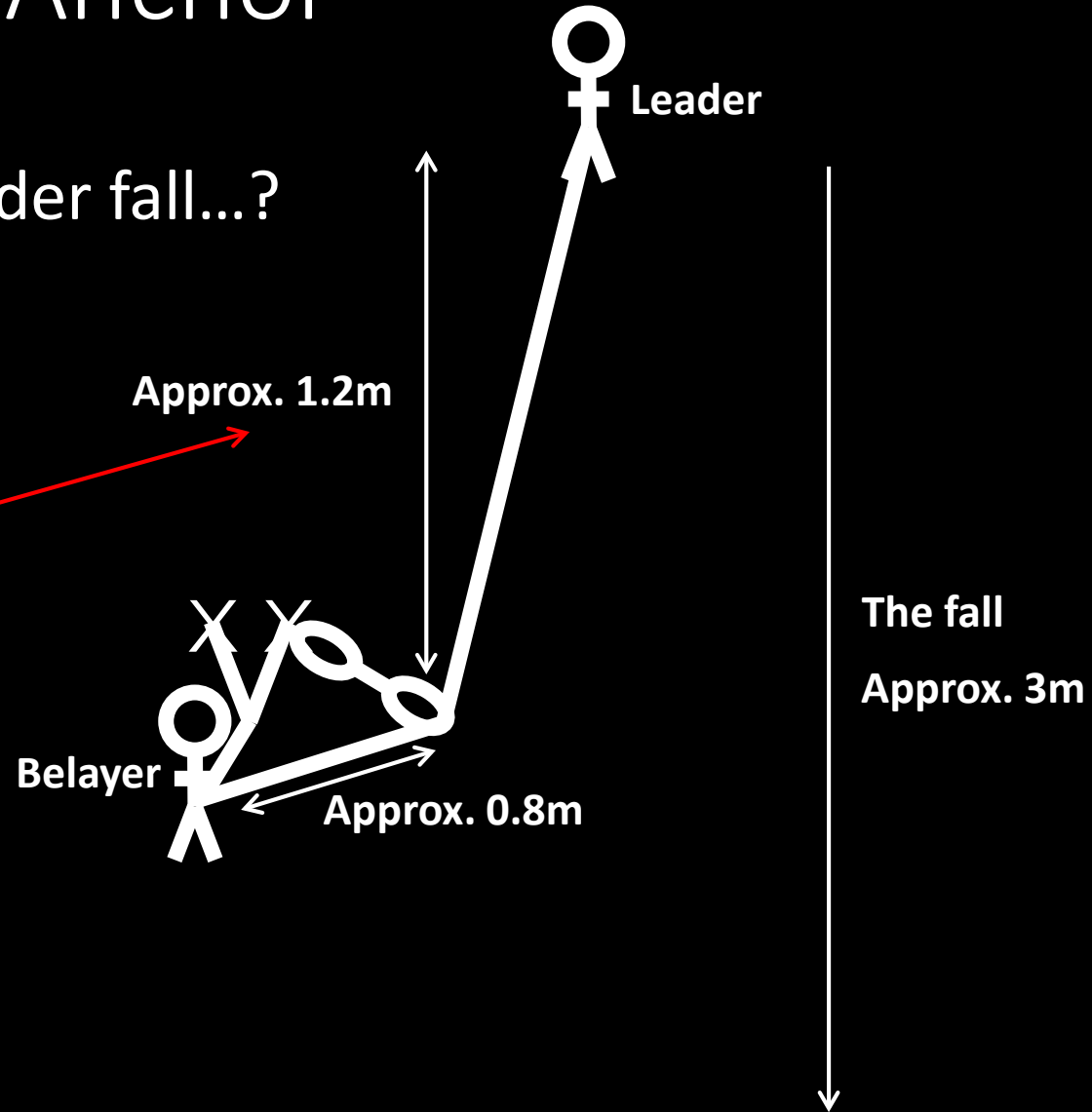




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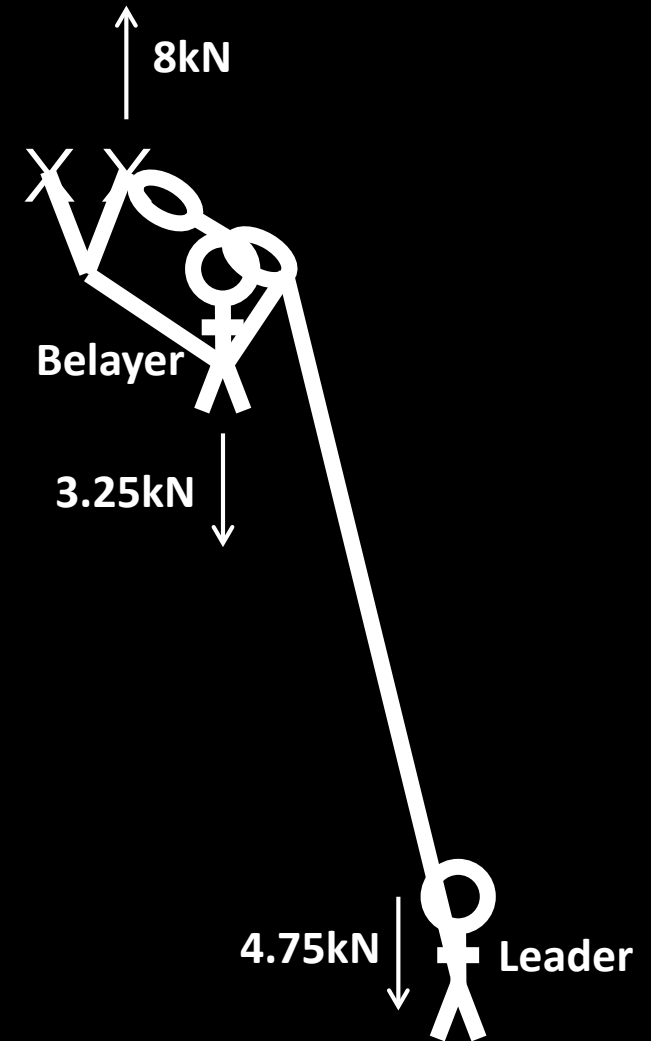
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**Practically speaking, at this distance the leaders feet are even with the anchor components.**



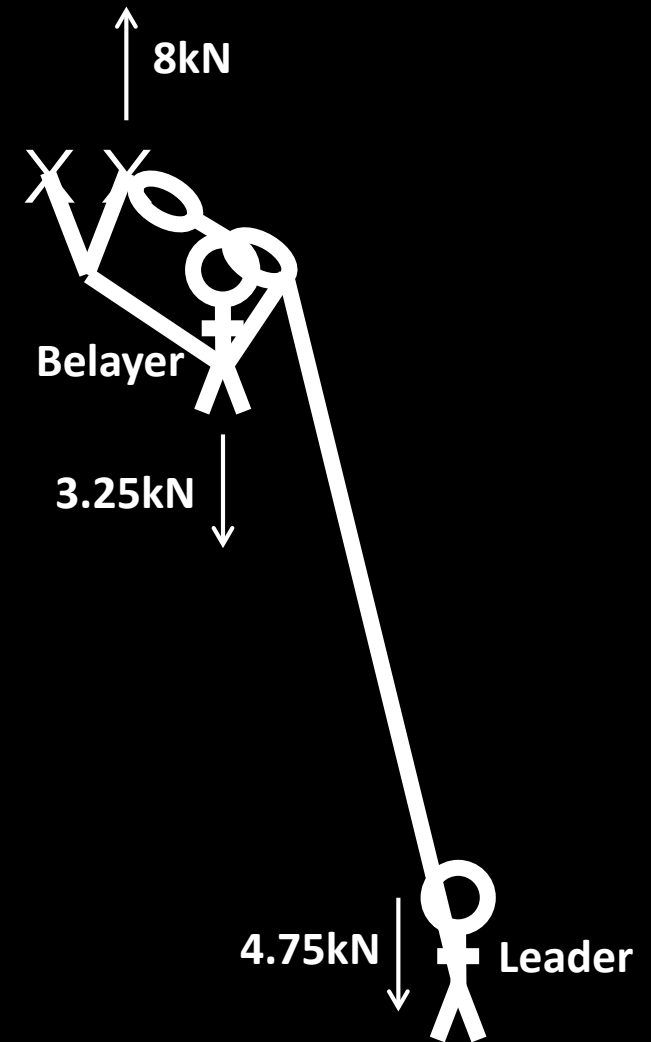
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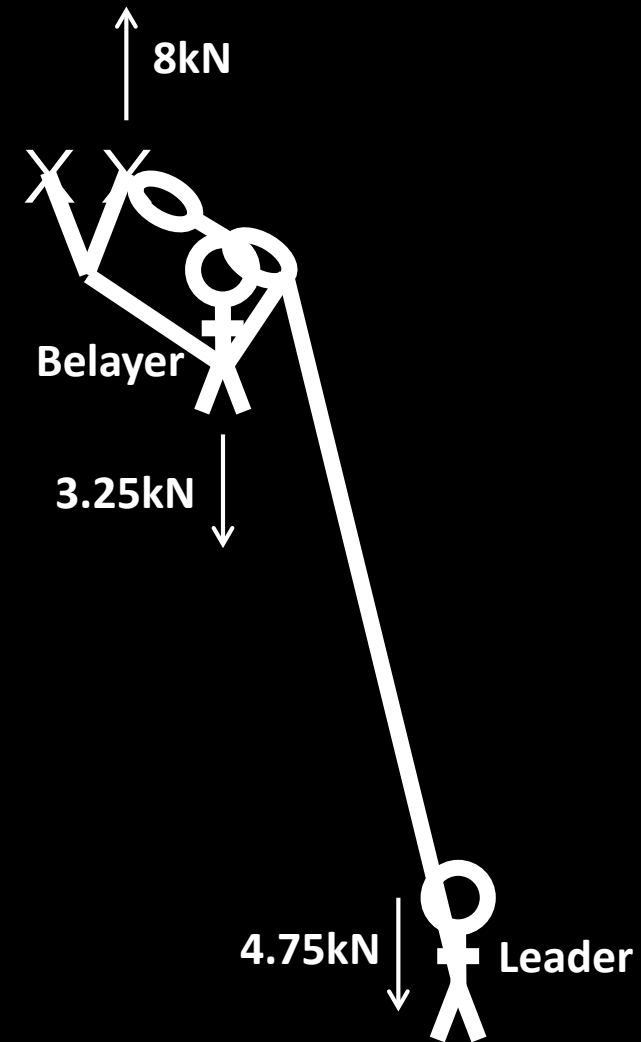
## 4. Redirect on the Anchor

- Assumes an ABD
- $< 6\text{kN}$  on leader, so “acceptable” per EN standards *at this fall height*
- The higher the leader climbs, the greater the force and the less “acceptable” this becomes
- $3.25\text{kN}$  on belayer  $\rightarrow$  sucked into first piece
- Will belayer catch the fall?!



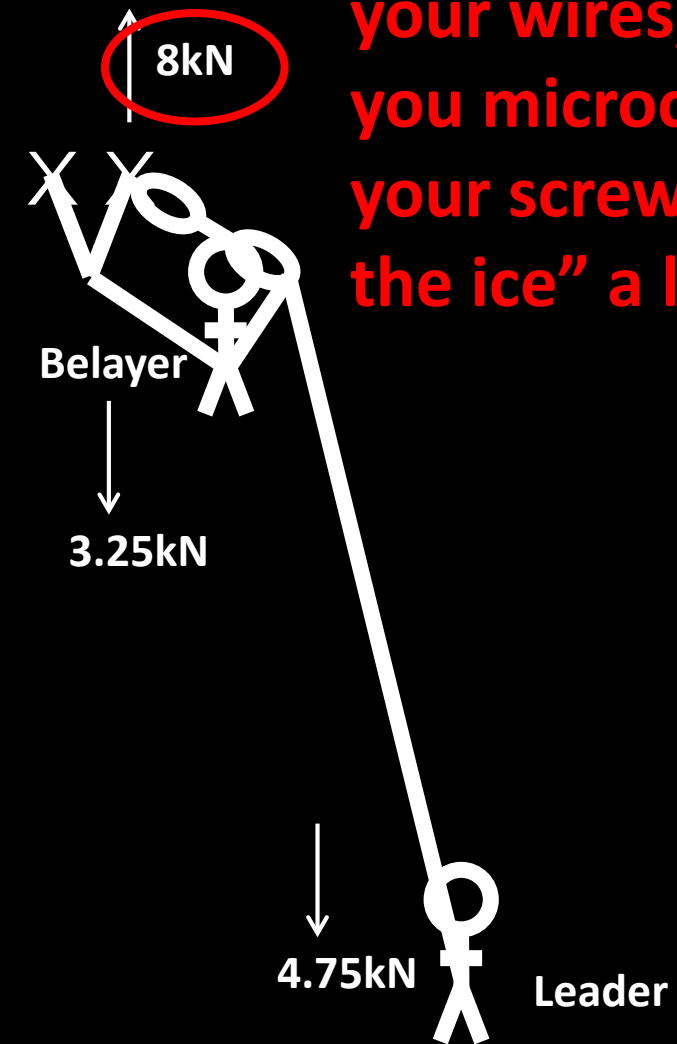
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- **Belayer moved violently, ABD might jam**



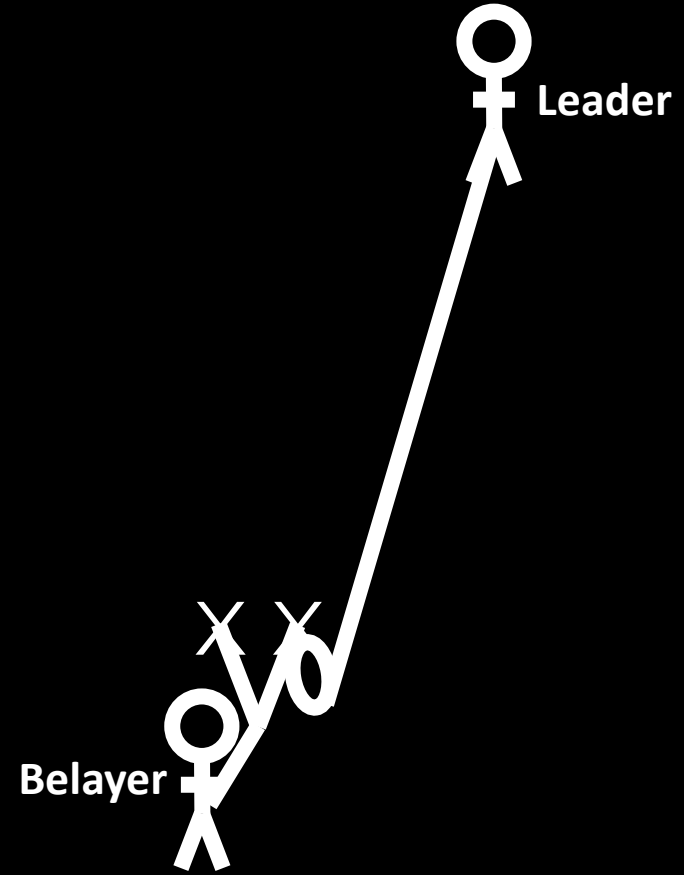
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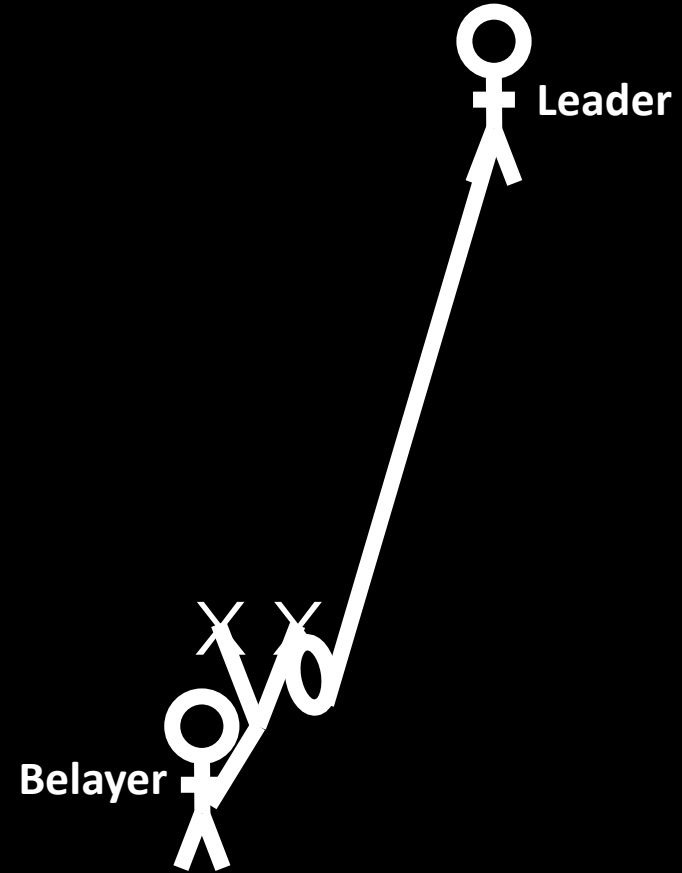
This is A LOT of force. Like “snap your wires, break you microcams, rip your screw out of the ice” a lot.

# 5. Fixed-Point Belay



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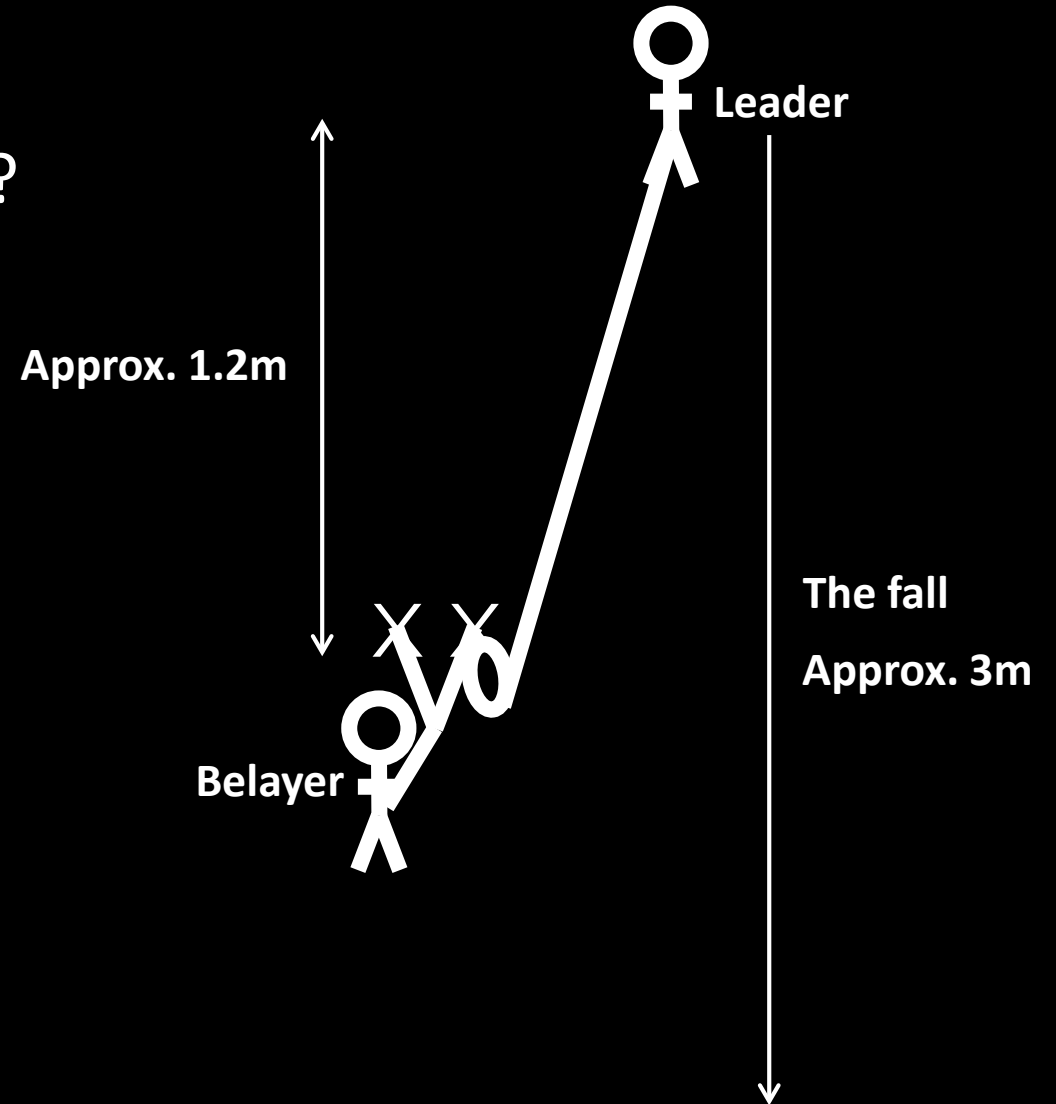
- MUST use an MBD, i.e. something that lets rope slip
  - Munter or tube





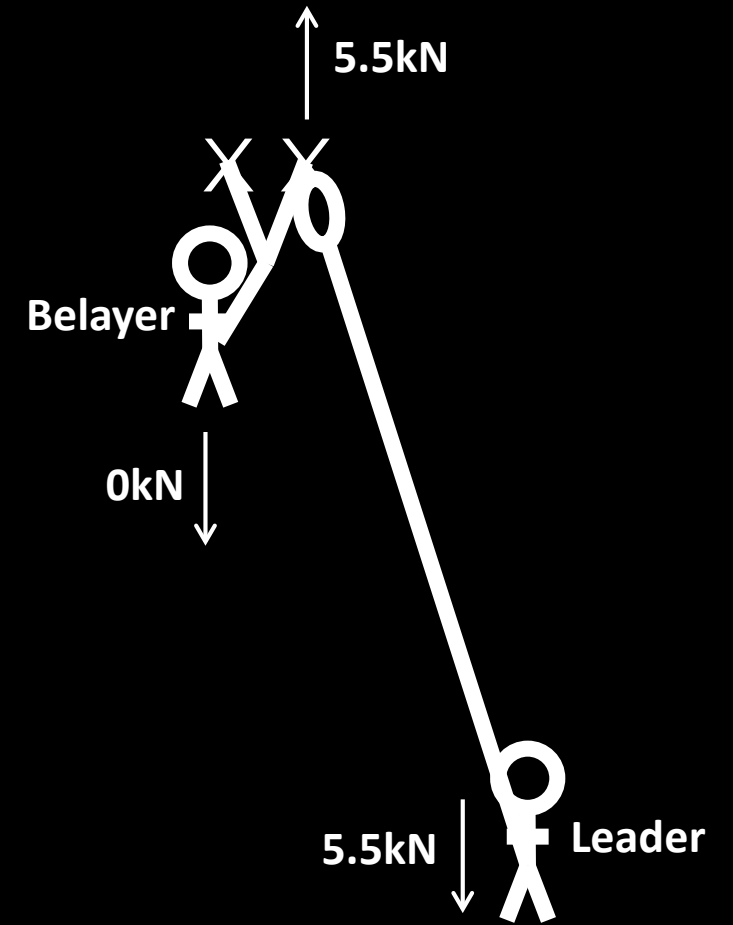
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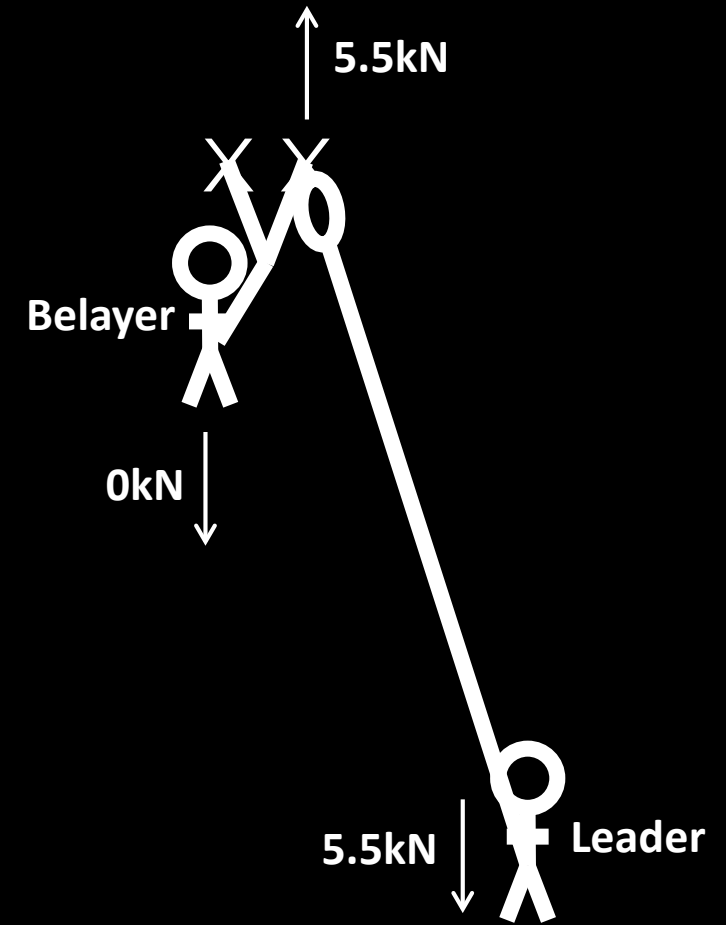
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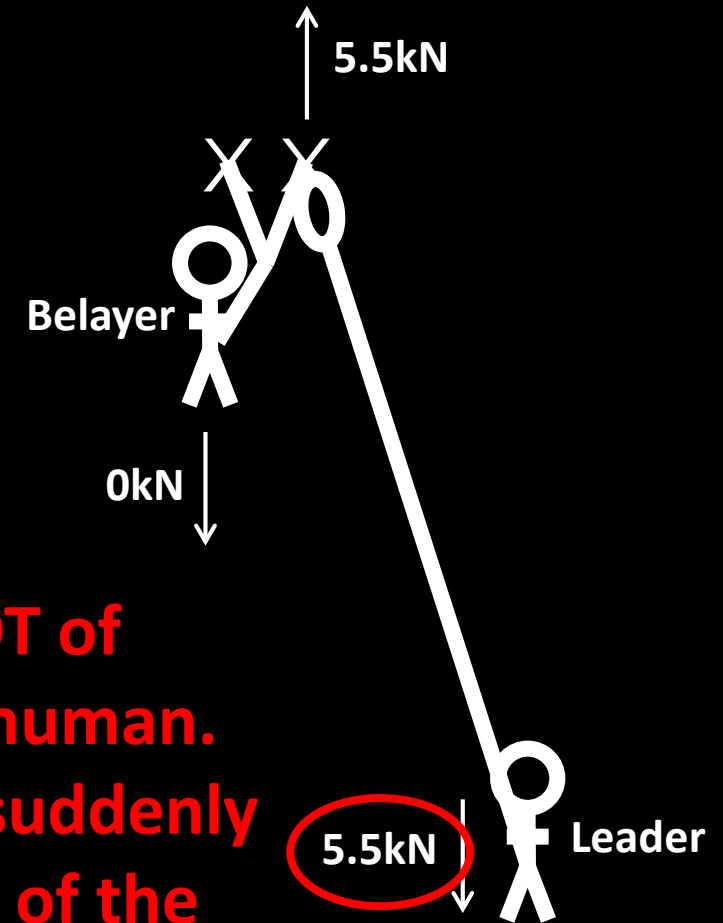
# 5. Fixed-Point Belay

- Assumes an MBD—**CANNOT use ABD**
- **Belayer needs gloves** (probably a good idea in general)
- Lower force on anchor—pulley effect eliminated
- NO (or very little) force on belayer
- Greater force on climber, but “acceptable”



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**This is A LOT of force on a human. Like “I am suddenly very aware of the existence of both my kidneys” a lot.**

# Fixed-Point Belay Rigging

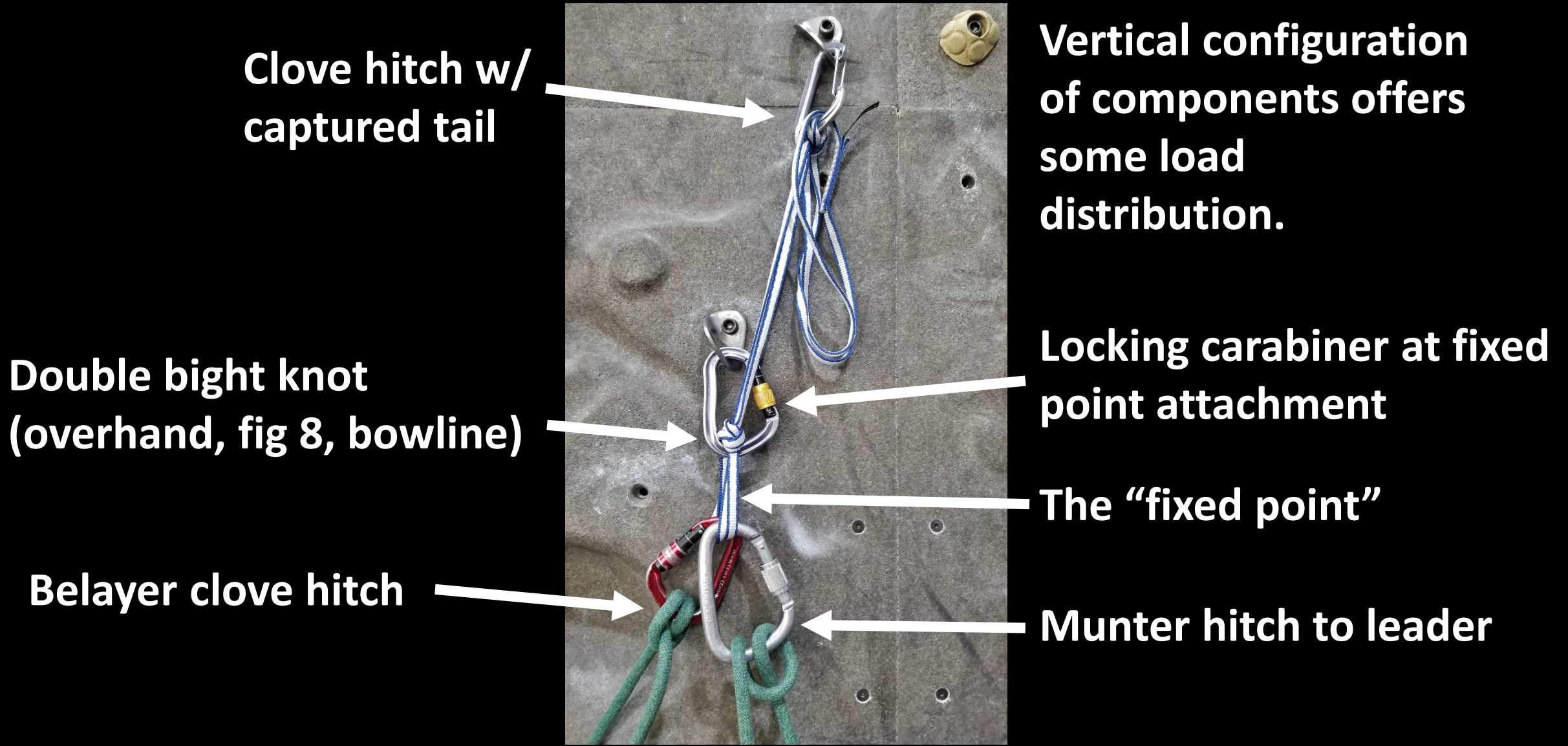


# Fixed-Point Belay Rigging: Banshee Belay





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# Fixed-Point Belay Rigging: Banshee Belay



**Horizontal configuration of components offers redundancy but not load distribution.**



# Fixed-Point Belay Rigging: Banshee Belay



**Construction with the rope offers simplicity and minimal equipment. Most convenient when swapping leaders.**

# Fixed-Point Belay Rigging

- What about distribution/equalization?!

# Fixed-Point Belay Rigging: Distribution

- True distribution is not attainable in the field.
- “Static” systems: 75/25 or 3:1 is realistic
  - Ponytail
  - Cordelette
  - Wishbone aka swamp
- “Dynamic” systems: 60/40 or 1.5:1 (best case)
  - Quad
  - Equalette
  - Sliding-x

# Fixed-Point Belay Rigging: Distribution

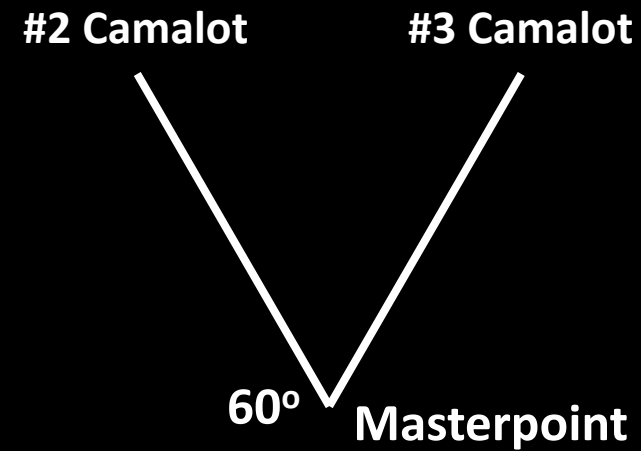
- Real-world example:

Well placed #2 and #3 Camalots  
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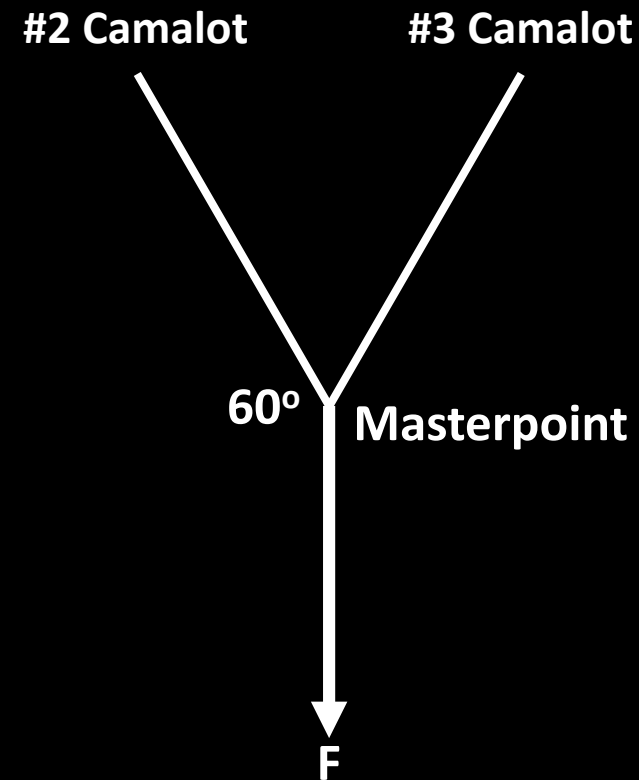


# Fixed-Point Belay Rigging: Distribution

- Real-world example:

Take a 3m fall with a redirect on the masterpoint.

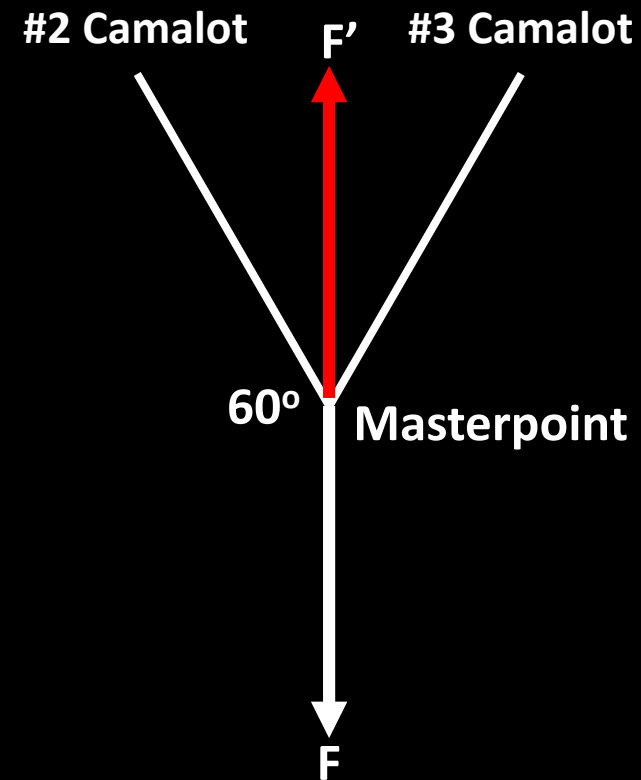
$$F = 8\text{kN}$$



# Fixed-Point Belay Rigging: Distribution

- Real-world example:

$$F = 8\text{kN} \rightarrow F' = 8\text{kN}$$

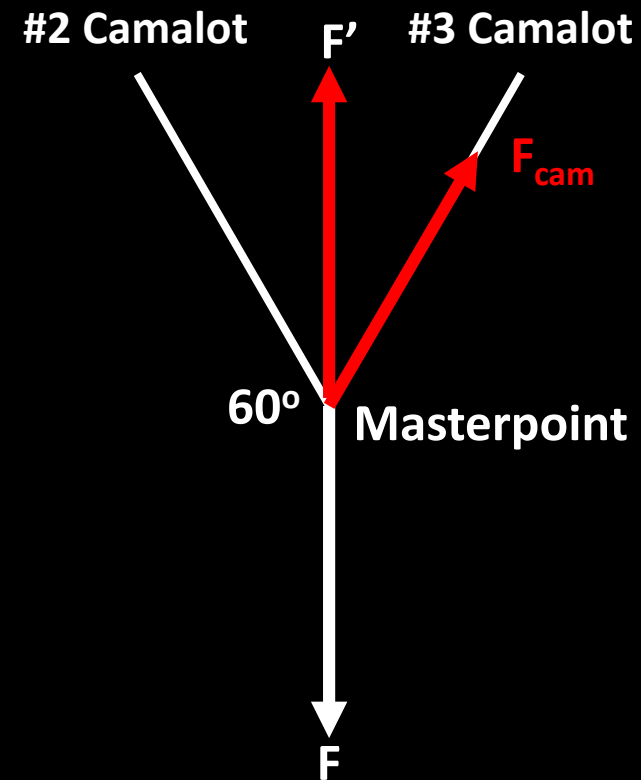


# Fixed-Point Belay Rigging: Distribution

- Real-world example:

$$F = 8\text{kN} \rightarrow F' = 8\text{kN}$$

$$F_{\text{cam}} = \frac{2F'}{\sqrt{3}}$$





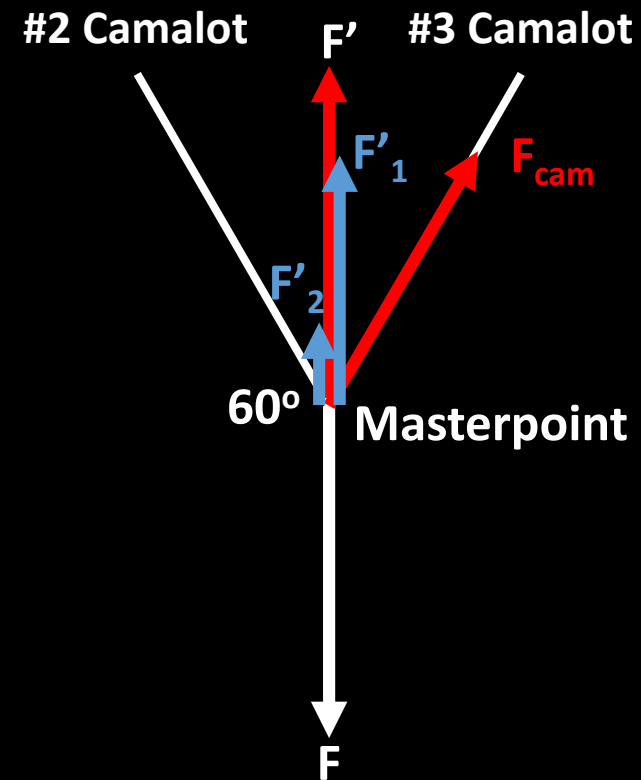
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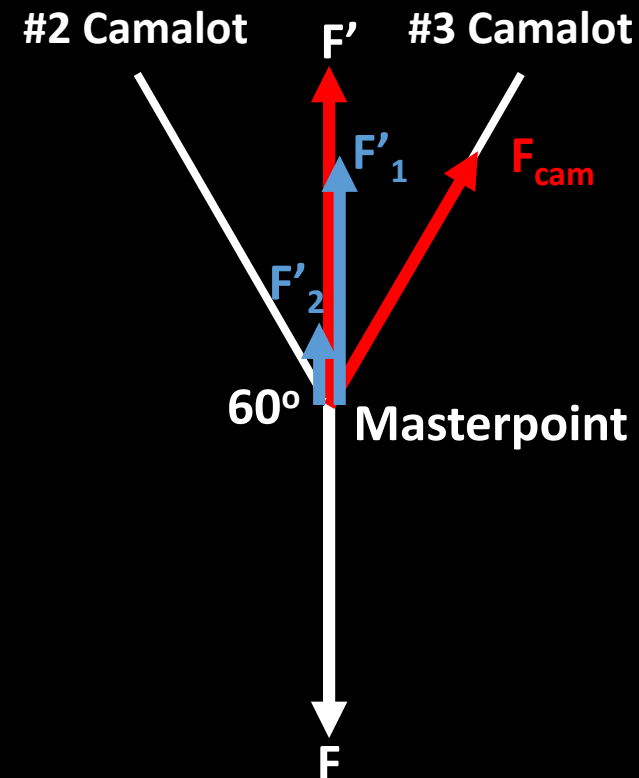
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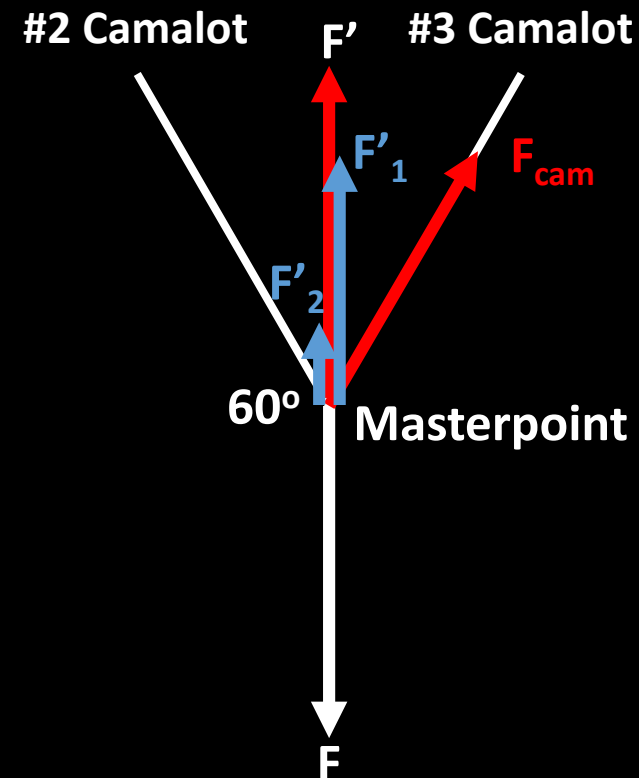
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$$F' = F \text{ \& } F'_1 = 0.75F'$$

$$\therefore F_{\text{cam}} = \frac{1.5F'}{\sqrt{3}}$$

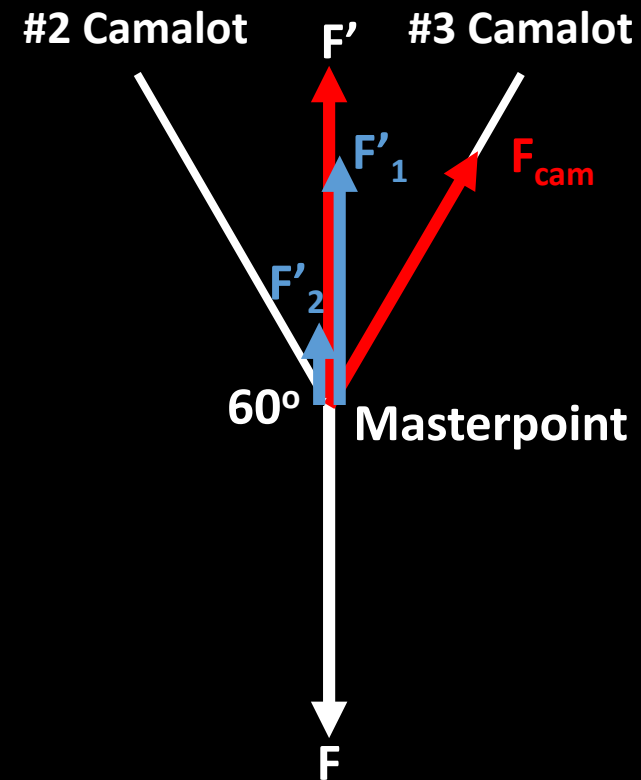


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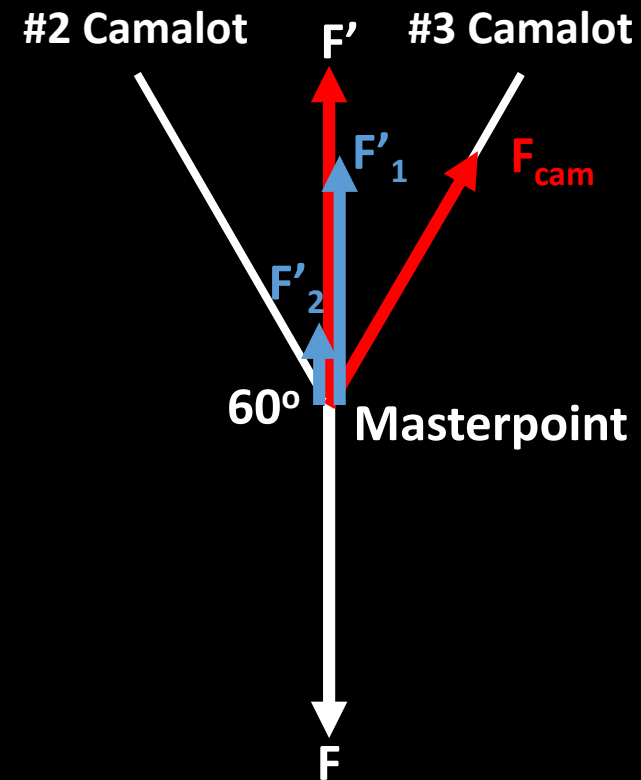
$$F_{\text{cam}} = \frac{1.5F'}{\sqrt{3}}$$

If  $F = 8\text{kN}$ ,  $F_{\text{cam}} \approx 7\text{kN}$



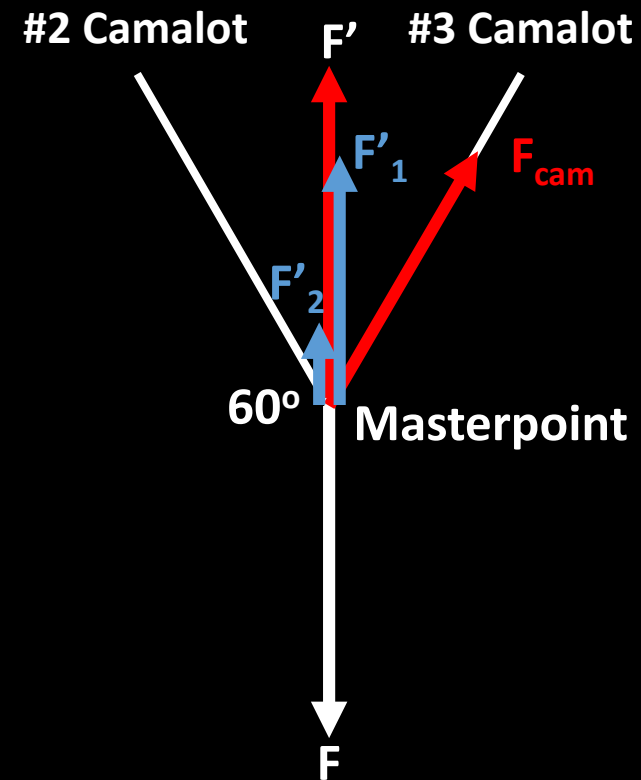
# Fixed-Point Belay Rigging: Distribution

- Real-world example:  
In other words, distribution doesn't buy you much (about 1kN).



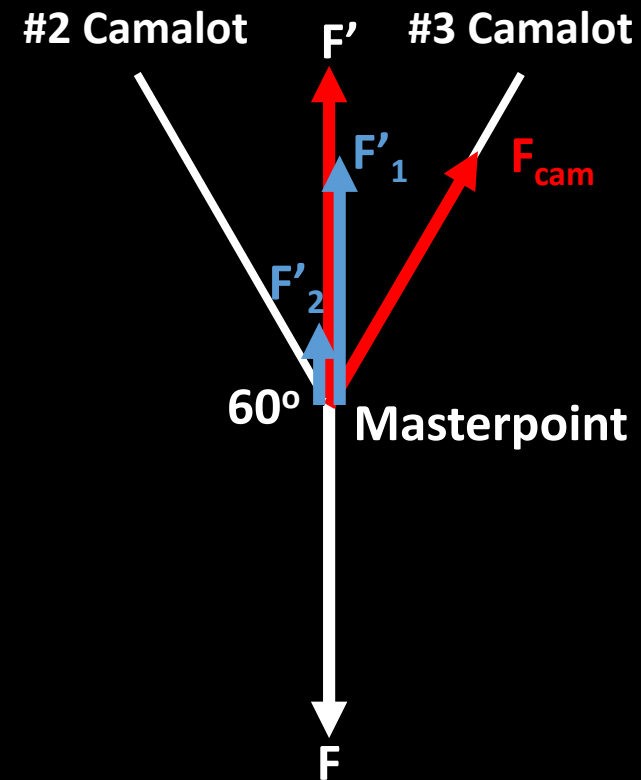
# Fixed-Point Belay Rigging: Distribution

- Real-world example:
- Working backwards...
- 14kN cam breaks with 16kN on the masterpoint.
- A 10kN ice screw breaks with 11.5kN.



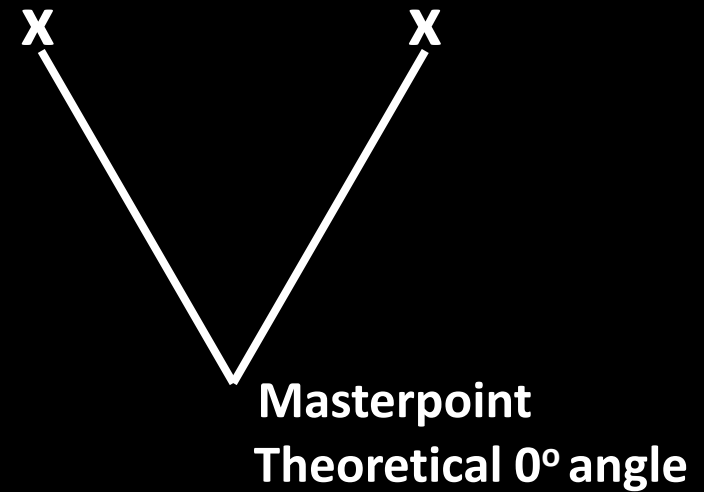
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- The placement/rock/ice could fail at lower loads.



# Fixed-Point Belay Rigging: Distribution

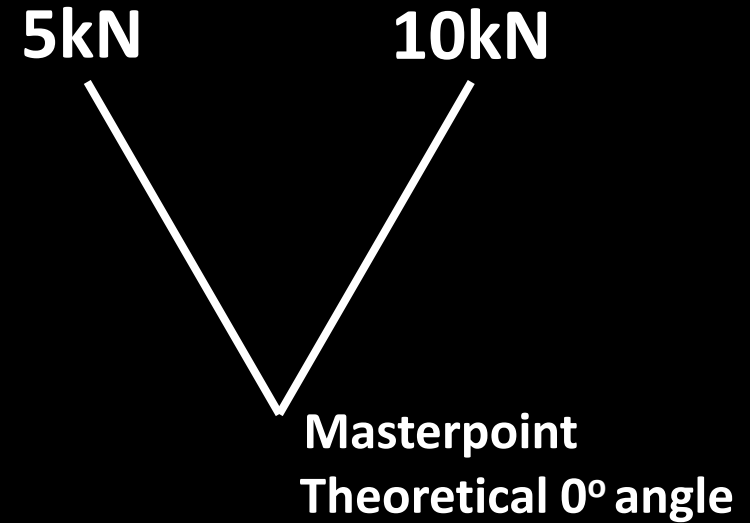
- What about dynamic rigging systems?





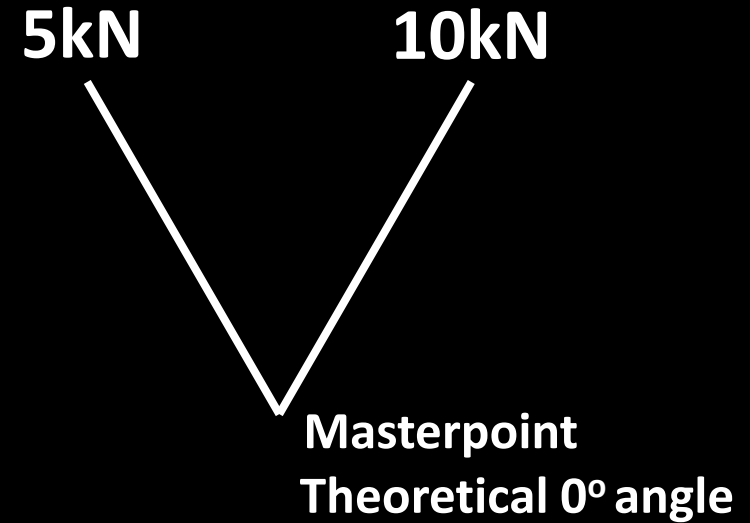
# Fixed-Point Belay Rigging: Distribution

- Assume one anchor twice as strong



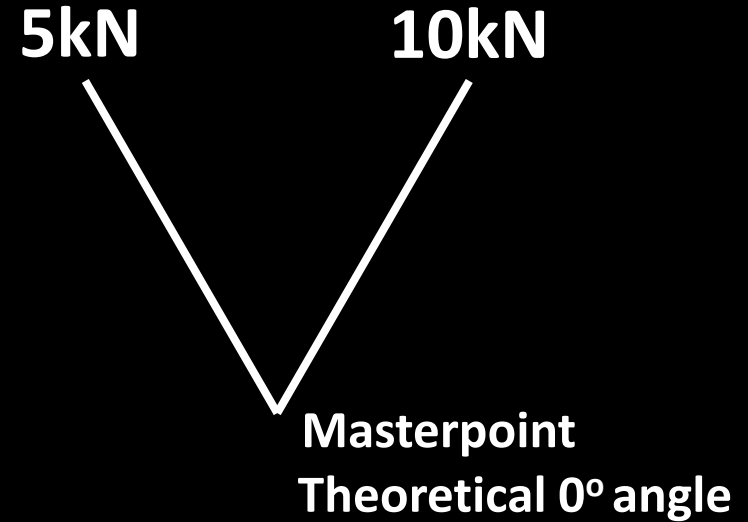
# Fixed-Point Belay Rigging: Distribution

- How strong is this anchor?



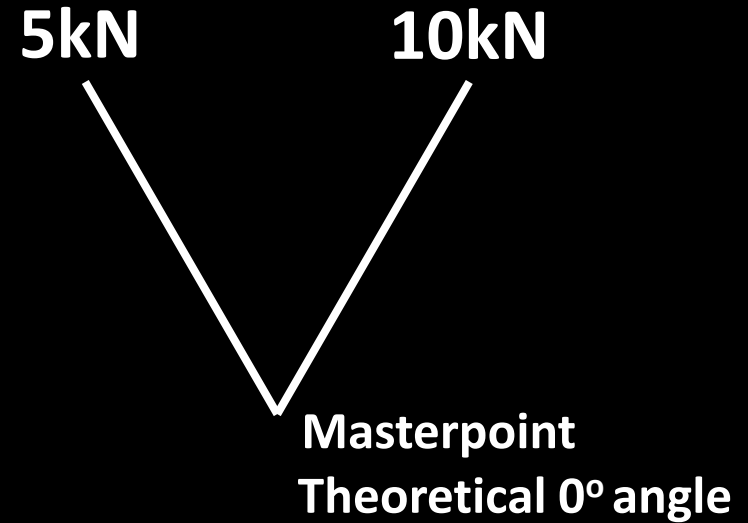
# Fixed-Point Belay Rigging: Distribution

- How strong is this anchor?
- 15kN? (additive rule)



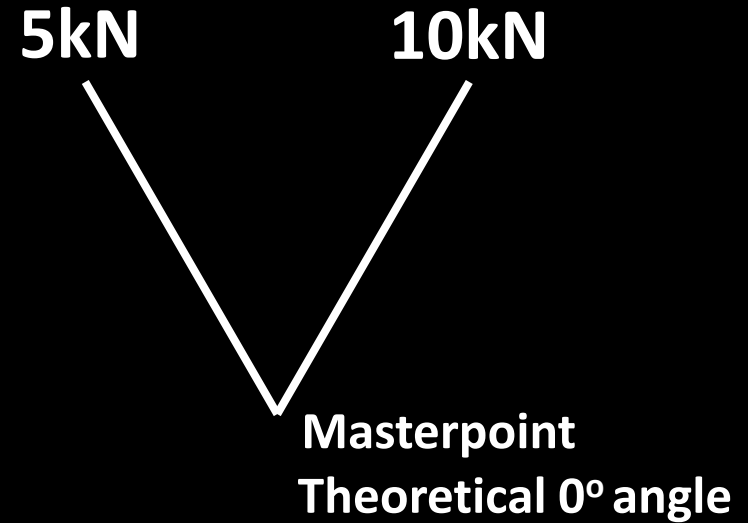
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- How strong is this anchor?
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- 7.5kN?



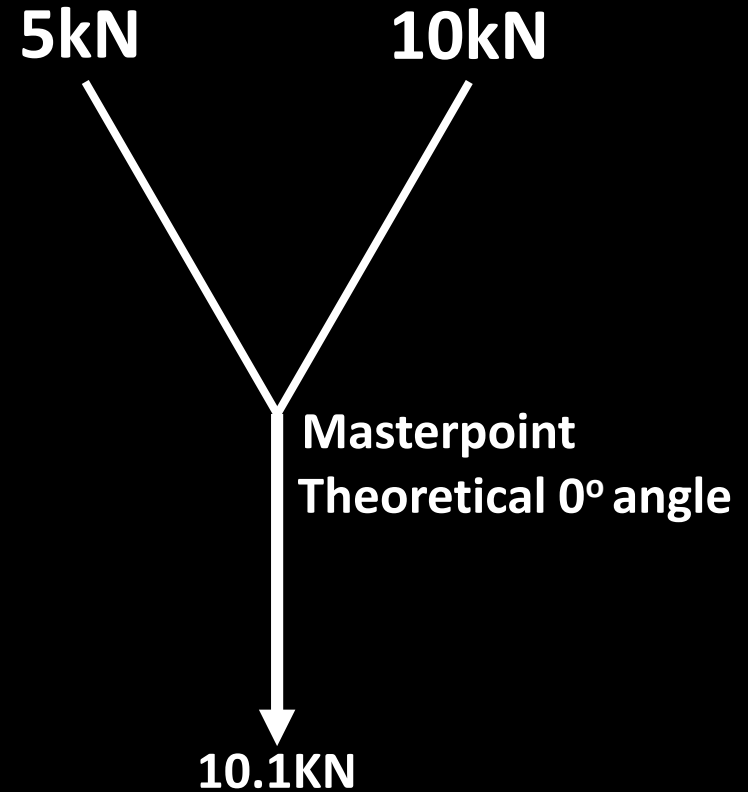
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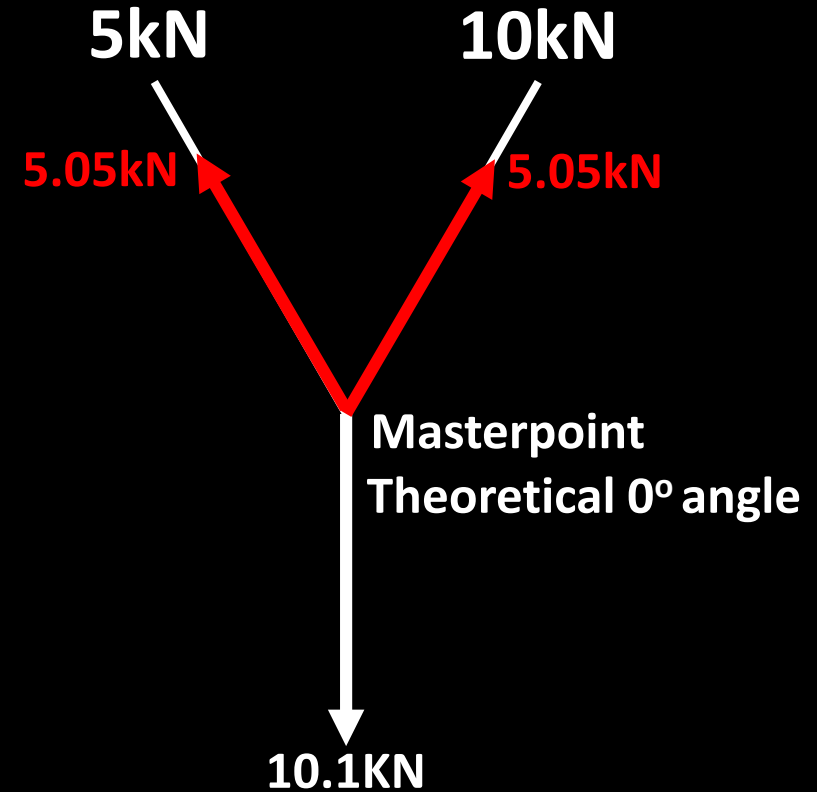
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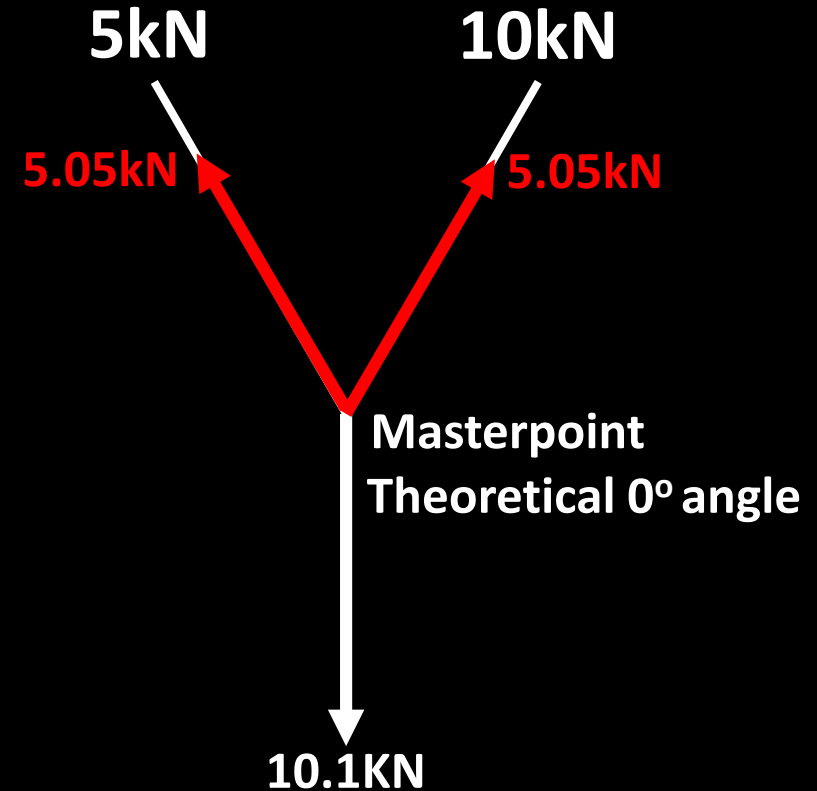
# Fixed-Point Belay Rigging: Distribution

- How strong is this anchor?
- 5.05kN each leg



# Fixed-Point Belay Rigging: Distribution

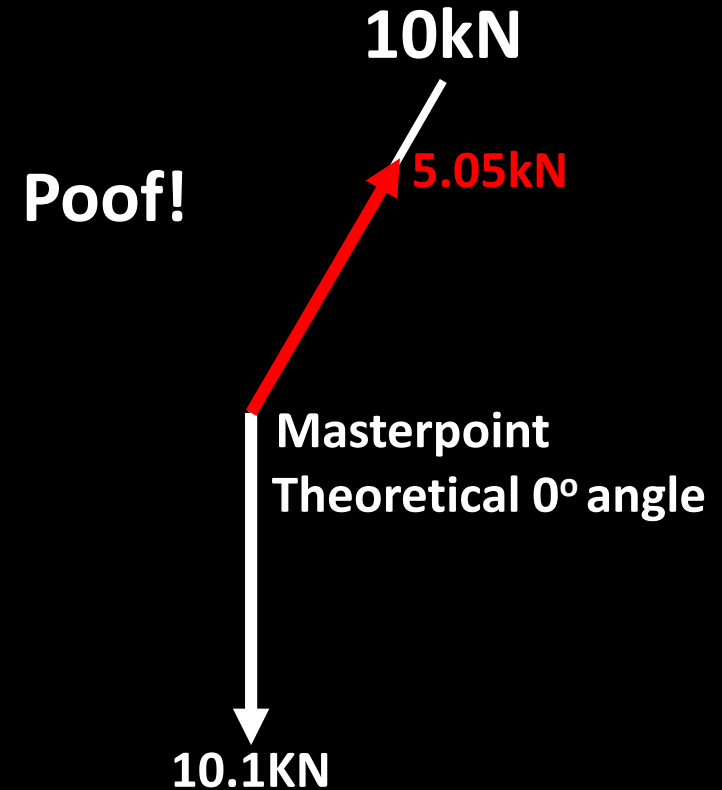
- How strong is this anchor?
- 5.05kN each leg
- First leg fails!





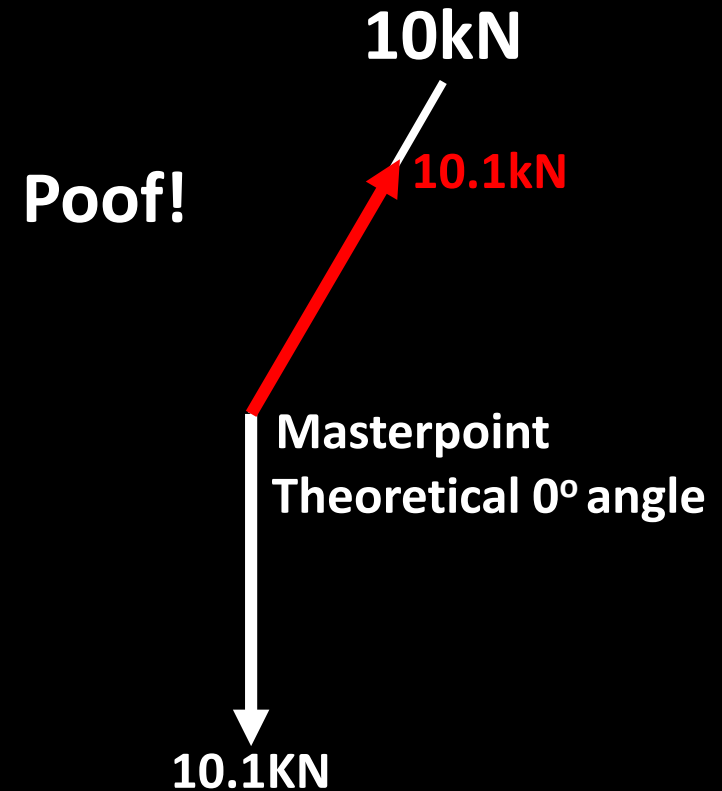
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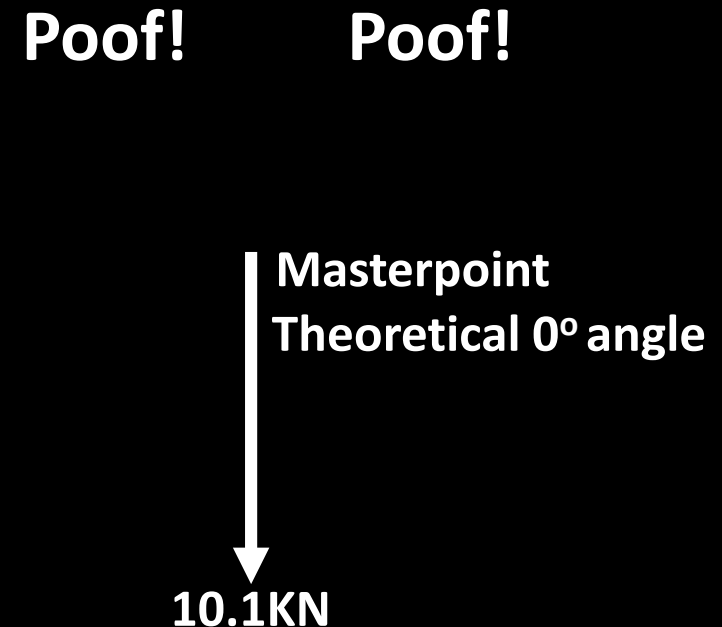
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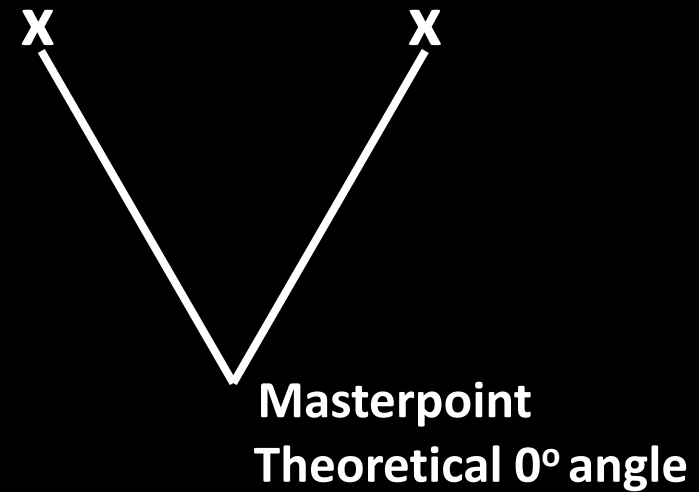
# Fixed-Point Belay Rigging: Distribution

- How strong is this anchor?
- 5.05kN each leg
- First leg fails!
- Second leg fails!
- Climbing career is over

**It's not the fall, it's  
the sudden stop...**

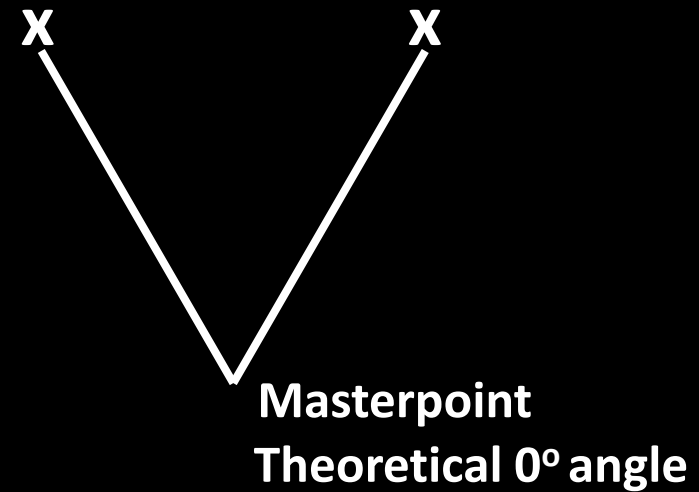
# Fixed-Point Belay Rigging: Distribution

- Therefore, dynamic rigging makes sense (from strength standpoint) if the anchor components are roughly equal in strength AND neither component strong enough on its own (in which case simply use static rigging or banshee system).



# Fixed-Point Belay Rigging: Distribution

- Extension as a result of component failure can cause not-insignificant increases in the load on the remaining component.
- Since dynamic rigging is best applied with comparable strength components, failure of one component implies strong chance of failure for remaining component.



# Fixed-Point Belay Rigging: Distribution

- If single piece could take the load, focus on redundancy (i.e. fixed-point/banshee or static rigging)

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- If single piece could take the load, focus on redundancy (i.e. fixed-point/banshee or static rigging)
- (Of course, with two good bolts, you can probably do just about whatever you want...)



# Fixed-Point Belay Rigging

- Back to rigging options...

# Fixed-Point Belay Rigging: Banshee Belay



**The general case. Works well for two bolts (vertical preferred to horizontal) or ice screws.**

**“Fixed point” should allow no more than 20cm of travel.**



# Fixed-Point Belay Rigging: Locker Draw



**Requires bomber, trustworthy hardware. Sacrifices redundancy. May sacrifice distribution (depending on bolt spacing and length of draw). Can be built to size with ice screws and/or cams. VERY efficient for time and materials.**



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**Redundant variation. Requires bomber, trustworthy hardware. May sacrifice distribution (depending on bolt spacing and length of draw). Can be built to size with ice screws and/or cams. Also VERY efficient for time and materials.**



# Fixed-Point Belay Rigging: Quickdraw



**Redundant variation. Requires bomber, trustworthy hardware. May sacrifice distribution (depending on bolt spacing and length of draw). Can be built to size with ice screws and/or cams. Sacrifices security of locker draw. Also VERY efficient for time and materials.**



# Fixed-Point Belay Rigging: One Bolt



**Requires bomber, trustworthy hardware. Sacrifices redundancy at the fixed point. Very quick to rig with a typical masterpoint or a quad.**



# Fixed-Point Belay Rigging: Power Triangle





# Fixed-Point Belay Rigging: Power Triangle

2-piece anchor



Masterpoint/Fixed Point



Two point masterpoint anchor. Fixed point created by securing masterpoint with upward pull piece. Often creates very comfortable belay position.

Upward-pull piece





# Fixed-Point Belay Rigging: Power Triangle Var.



**Two point masterpoint anchor. Fixed point created by securing masterpoint with upward pull piece. If such a piece is not convenient, backside of belayer clove hitch can fixed to upward pull piece.**

**To upward-pull piece**



# Fixed-Point Belay Rigging: Cam Slings



**Two cam slings. Works for horizontal anchor configurations where other options may not. Can rig with a typical masterpoint anchor.**



# Fixed-Point Belay Rigging: Double Ropes





# Fixed-Point Belay Rigging: Double Ropes



For double rope systems, a tube device can be used. The tube must have a redirect carabiner at least until the leader clips the first piece. Using a non-locking carabiner can minimize confusion for the belayer.

**Redirect carabiner**



# Fixed-Point Belay Rigging: DO NOT!!!





# Fixed-Point Belay Rigging: DO NOT!!!



**The fixed point must be “fixed” with a maximum 8 inches of travel (ideally less). DO NOT use it on a traditional masterpoint.**



# Fixed-Point Belay Rigging: DO NOT!!!





# Fixed-Point Belay Rigging: DO NOT!!!



**A manual braking device must be used. Assisted braking device can cause catastrophic damage to the lead climber and/or the anchor.**



# Fixed-Point Belay: Anchor Failure?

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- Modern bolted anchors largely eliminate the risk of anchor failure.
- It's a good idea not to lead fall directly onto the anchor regardless.

# Fixed-Point Belay: Application

- CANNOT relocate anchor, chariot belay, pre-clip first piece
- High probability of falling
- Run-out terrain
- Steep/difficult climbing
- “Low friction” rope system—little rope drag/rope on rock
- Overhead hazard to belayer (roof, ice cave, etc.)
- Lightweight belayer

# Fixed-Point Belay: Example Routes

- “Risky Business” Red Rock, NV
- “Escape Artist” Black Canyon, CO
- “Slippery When Wet” Ouray, CO
- “Thin Air” Cathedral Ledge, NH
- “Cascading Crystal Kaleidoscope” Gunks, NY
- “Lost in Space” Linville Gorge, NC
- Black Velvet Wall, Red Rock, NV

# Fixed-Point Belay: Application

- Hybrid system:
  - Pre-rig belay device on harness (can be ABD)
  - Dump out slack, tie back up knot if appropriate
  - Fixed-point belay
  - Establish a few solid pieces of protection
  - Remove fixed-point belay
  - Belay from harness

# Fixed-Point Belay Rigging: Final Notes



- Position fixed point between waist and eye level of belayer (chest level very comfortable to operate).
- Can use second client to back-up the belay/manage ropes.
- Can also use second client as redirect belayer when employing hybrid system.



Questions?



Derek DeBruin belayed by Sam Latone on "Glass Menagerie" at Looking Glass Rock, North Carolina.  
Photo: Samantha Henry