Physics of Rock Climbing
Open Questions

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SP.255
Feb 21, 2006
Overview

where the questions come from

Accidents
Demographics
Litigation
Marketing
Development of the game

questions & how to answer them

Open Questions
Model
Experiment

the shape of answers

Knowledge
Standards
Curriculum
New gear design
New usage

information access/bibliography
Safety

• Component approach
• System approach
• Social/Organization approach
• Personal approach
• SP.255 approach
Question Beggars

• Accidents:
• Innovation: The equipment gets “better”
• Demographics: Age, latitude…
• Behavior: How people climb
• Related sports & occupations:
• Marketing:
• Litigation:
• Standards & Standardization:
The Answer Mill

• Modeling
• Experiment
• Simmering
Modeling

$$A_{contact} = 2\sqrt{\frac{4F_{normal}(1 - P^2)\pi RADIUS WIDTH}{\pi E}}$$

$$T = \frac{1}{2} F \sin \theta$$

$$V = \frac{1}{2} F \cos \theta$$

$$M_b = \frac{1}{2} FR_1 \left( \frac{2}{\pi} - \sin \theta \right)$$

$$\sigma_{xt} = \frac{T}{A} = \frac{F \sin \theta}{2\pi R_2^2}$$

$$\tau_{yz} = \frac{V}{A} = \frac{F \cos \theta}{2\pi R_2^2}$$

$$\sigma_{xmb} = \frac{M_b r}{I_\Theta} = \frac{1}{2} FR_1 r_2 \left( \frac{2}{\pi} - \sin \theta \right) \frac{\pi}{4} R_2^4$$

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<th>m belayer</th>
<th>F bd</th>
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<th>l simple</th>
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Classification of Qs

- System components
- Systems & interactions
- Use & habits
System Components

- Ice axes—multiple uses perhaps deserve multiple standards
- EAS—standards & education
- Ropes—waterproofing, middle marker, sharp edge resistance, & abrasion resistance
- Aid Hooks—strength standard
- Belay/rappel devices—standards, usage, & performance measures
- Cams—new axel configuration analysis
- Ice screws—build a better ice screw & testing/standardization
- Bolts—warm, wet, & salty + sustainability
- Pads—use & standards
- Crampons—snow ball effect
- Nuts
- Slings & draws
- Harnesses
Systems and Interactions

• Crampon + boot
• Rappel/belay device + rope (+user)
• Carabiner + rope (frequency, radius of curvature, standards, education)
• Rappel/belay device + heat
• Via ferrata
• Artificial climbing walls
System Example: Via Ferrata
VF Outcomes
Use and Habits

• Official line vs. actual use (e.g. grigri)
• Belay methods
• Bouldering pads
• Lead climbing decision making
Use & Habits Examples

• DAV work on
  – Gym belaying
  – Avalanche awareness
  – Falling over
The Shape of Answers

- Curriculum
- Standards
- Better equipment
- Better habits and equipment use
- Information