Triangulating the Apdex Metric with Barry-3

Session 45A

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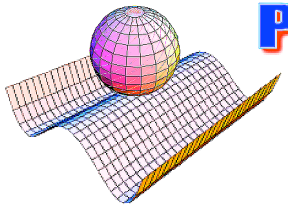

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Motivation

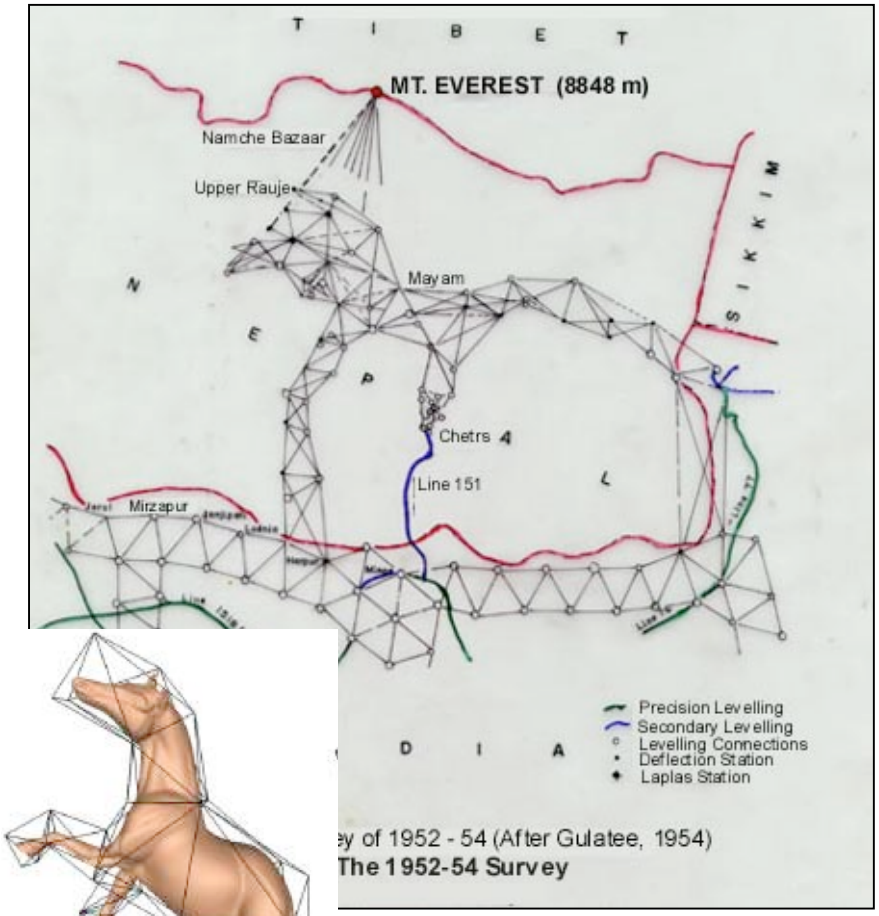
Better Performance Through
Better Visualization

How High is Mt. Everest?

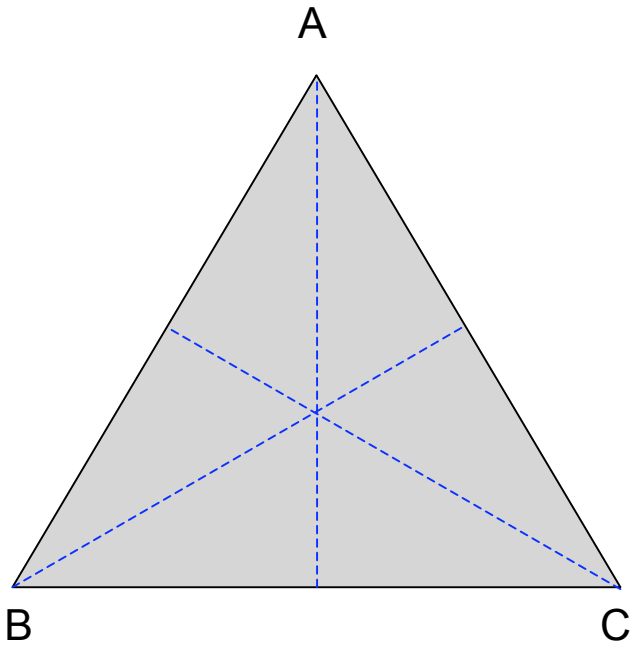
- Highest mountain in the world
  - How do we know that?
  - It's a single number (like A_T)
- Estimates have varied
  - It's rising a few mm each year
  - But moves northward several cm
  - GPS is less accurate for heights
- Surveyors solved this problem a long time ago

All Done with Triangles

- Surveying procedure
  - Triangulation
  - Start with short distances
  - Form triangular mesh
- Great Trigonometric Survey of India
  - How big is my colony?
  - Started by the British c.1790
  - George Everest joined in 1822
  - First estimate of Everest c.1850 was 8849m
  - Officially: 8848.82m
- Computer graphics
  - Similar idea
  - Triangular mesh for defining irregular shapes

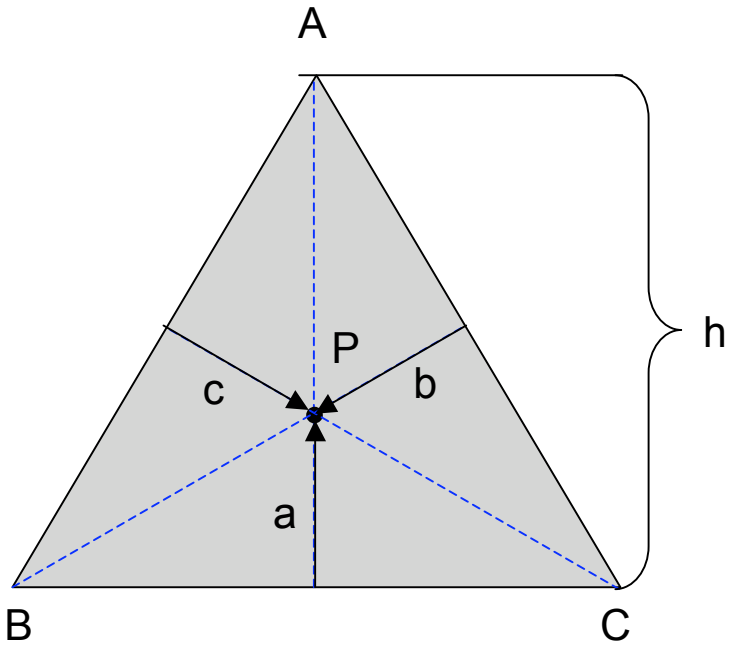


Some Facts About Triangles



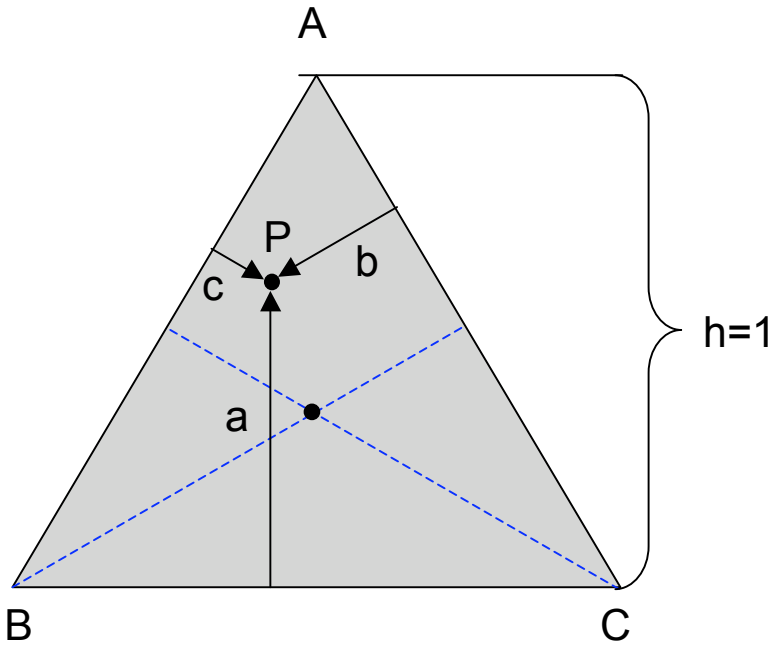
- In following, consider only equilateral Δ (each interior angle = 60°)
- For Δ sides of length 2, height h = $\sqrt{3}$
  - For Δ sides of length 1, height h = $\sqrt{3}/2$
  - For Δ sides of length $2/\sqrt{3}$, height h = 1
- Bisector of each side also bisects opposite interior angle (30°)

The Centroid



- *Centroid* (P) or "center of gravity" is 1/3rd height of the ∆ (h)
- By symmetry, centroid is at 1/3rd length of each bisector (b and c)
- We see: a + a + a = h and also know b = c = a
- Therefore: a + b + c = h (sum rule)

Barycentric Point



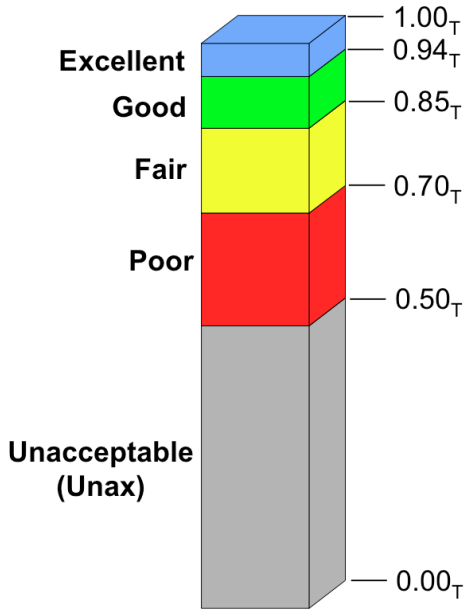
- Even if point P is moved away from centroid
  - Sum rule: a + b + c = h still holds
  - True for any point inside the Δ
- Choose h = 1 as a convenient normalization
- Any 3 metrics that sum to 1 can mapped to this coordinate system

Apdex Categories

- **Categorical data**
  - **Sampled RTT counts**
  - **Categorized by threshold time T**
    - *Satisfied* (0 < Sat < T)
    - *Tolerating* (T < Tol < 4T)
    - *Frustrated* (Frus > 4T)
- **Ratio of counts**
  - **If total counts in any period is *Cnt*, then Sat + Tol + Frus = Cnt**
    - Equivalently: (Sat/Cnt) + (Tol/Cnt) + (Frus/Cnt) = 1
  - **Think of each term as a percentage of Cnt**
    - Satisfied% + Tolerating% + Frustrated% = 100%
  - **More simply: s + t + c = 1**
    - Where: *s* = Satisfied%, t = Tolerating%, f = Frustrated%
- **Barycentric coordinates**
  - **s + t + c = 1 means each triple {s, t, c} is a barycentric point**
    - Only need a **pair** of {s,t,c} because of sum rule

Apdex Index

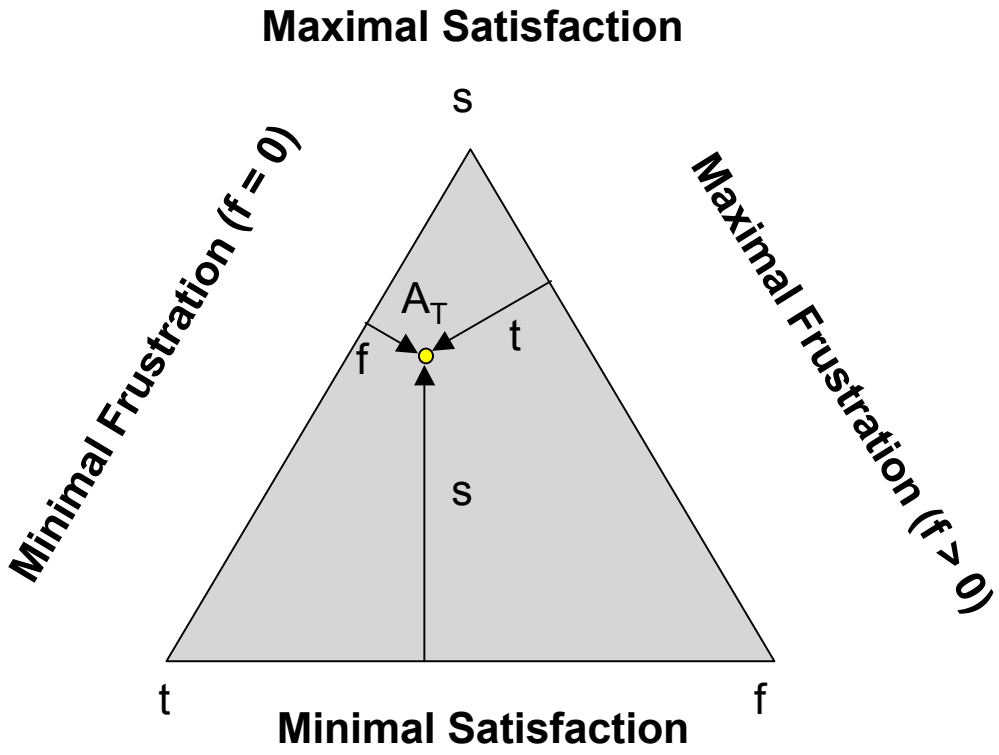
- Apdex categories define Index
  - $A_T = s + t/2$
- Application responsiveness
  - A_T based on RTT counts e.g., Gomez
  - User-perceived performance (not system performance)
- Single number A_T reported
  - Aimed at Executive Mgrs.
  - Normalized range: $0 < A_T < 1$
  - Colored zones for A_T values
- Some Limitations
  - How to compare 5 geographic A_T values for the *same* appln? (Table?)
  - How to compare 5 geographic A_T values for 5 apps? (messy)
  - Most enterprises need to compare 100's of apps? (give up?)
  - Also want to know how multiple A_T values change in time



Solution

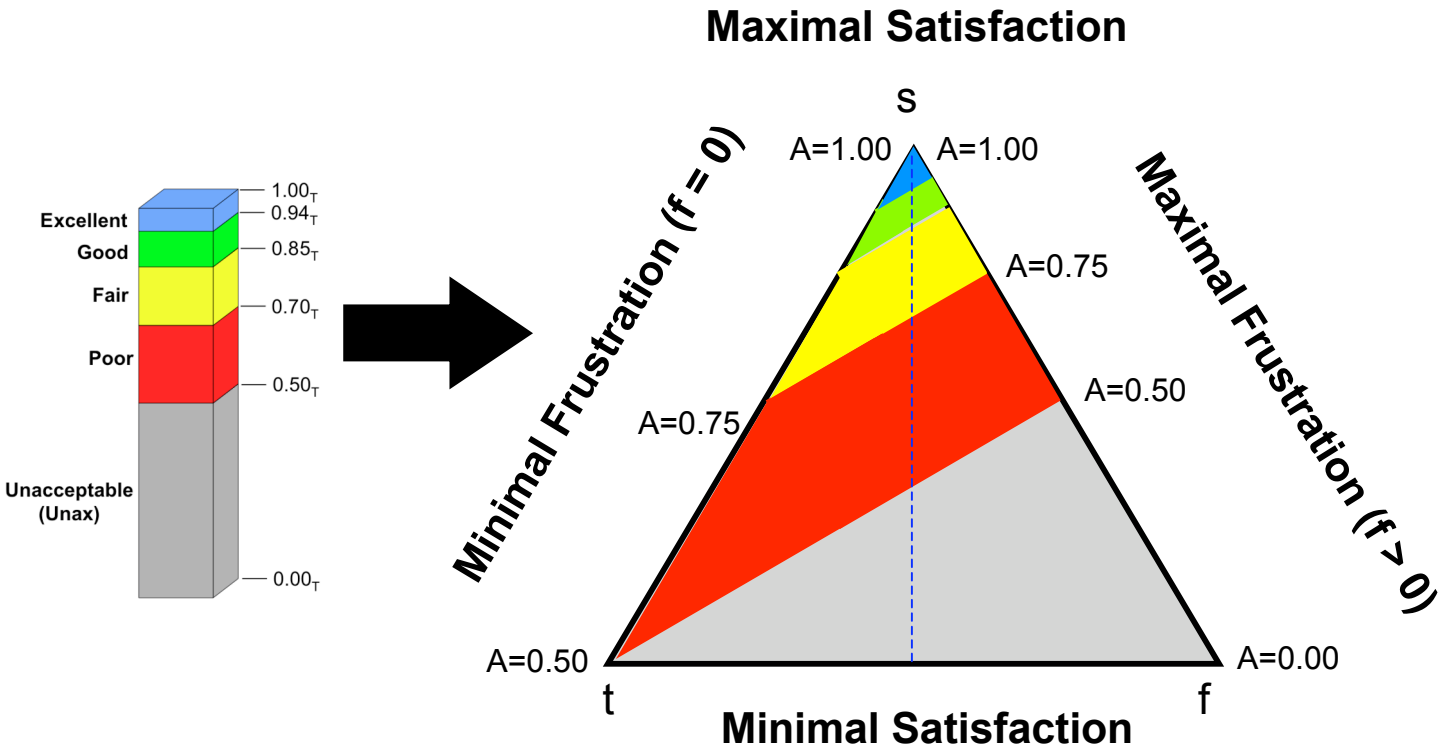
Mapping Apdex to Barry-3

Locating A_T in Barry-3



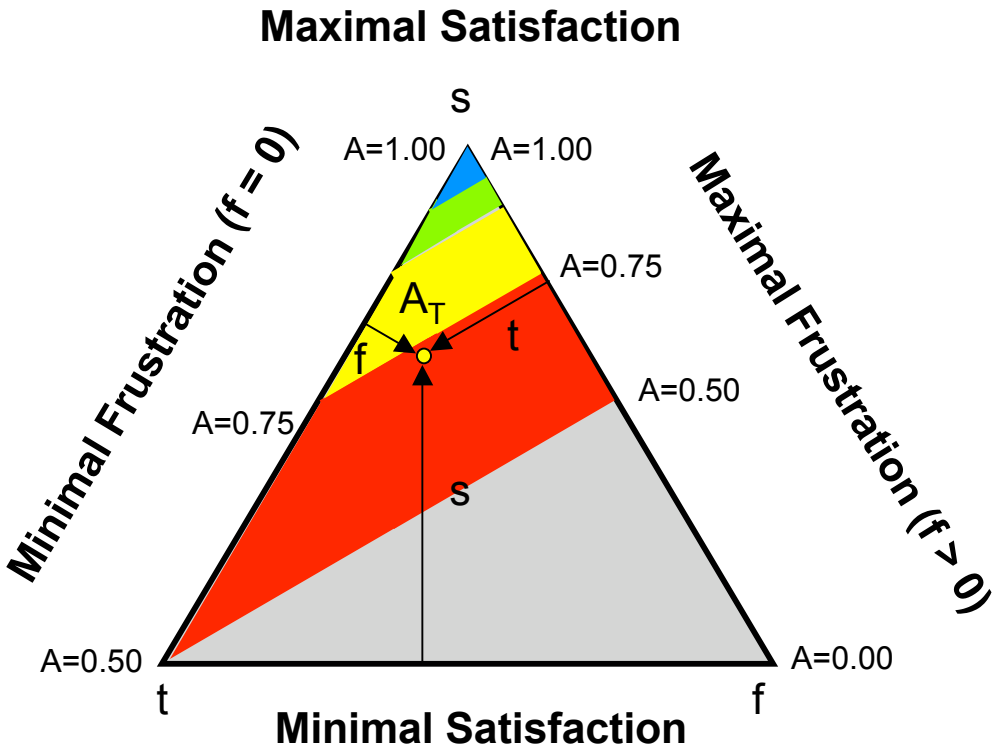
- Any 3 metrics that sum to 1 can mapped to Barry-3 system
  - Apdex categories: s + t + f = 1 (height)
  - Arrows {s,t,f} range from each side (min=0) to opp. interior angle (max=1)
- Limitation
  - Don't know the numerical value of A_T

Adding Numerical Apdex Zones



- A_T zones are *diagonal* bands
  - NOTE: Zone edges are parallel to Barry t-axis
- Zone boundaries are lines of constant A_T (*isoclines*)
- Zones are actually independent of Barry-3 coordinates

Combining A_T with Zones



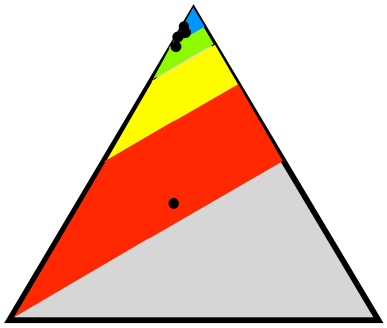
- Can visually estimate the value A_T from the Zone boundaries

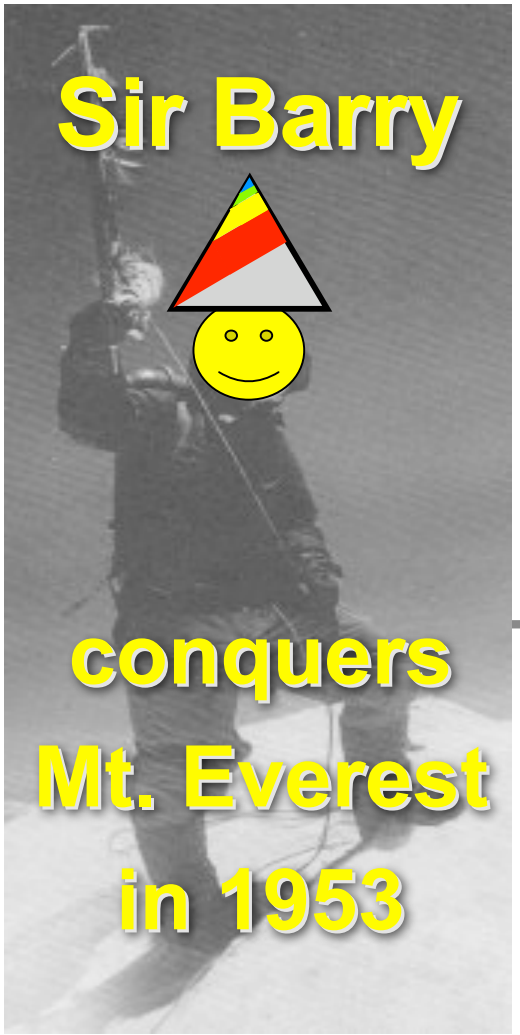
Example A_T Data in Barry-3

- Shown are 5 geographic measurements of the same application
  - Some points may cover each other
  - Most clustered near s = 1 apex in this sample
  - One straggler is near the centroid
- Data supplied by Peter Sevcik

Benefits of Barry-3

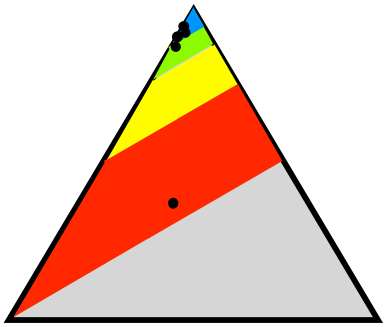
- Compact visualization
- Simultaneous metric display
  - Actual A_T index is a point inside triangle
  - Apdex categories {s,t,f} determine its position
- Disambiguation
  - Same A_T index can have different values of {s,t,f}
  - Don't pay attention if you don't care
- Apdex zones become colored diagonal bands
- Multiple applications
  - Represent each app by different marks or colored points
  - More data without making Barry-3 triangle larger
- Animating Changes
  - Changes in performance appear as movement of points
  - Can represent historical record of A_T index ("flight recorder")





Thank You

Questions?



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